MACHINERY

Design—Construction—Operation

Volume 46 **SEPTEMBER, 1939** **Number 1**

The National Machine Tool Exposition in Cleveland, to be held October 4-13, will be the main theme of October MACHINERY. The new machines to be shown at the Exposition will be illustrated and described, and other features of broad interest to the machinery industry are to be included. This Exposition Number, therefore, becomes one of especial interest to all production executives.

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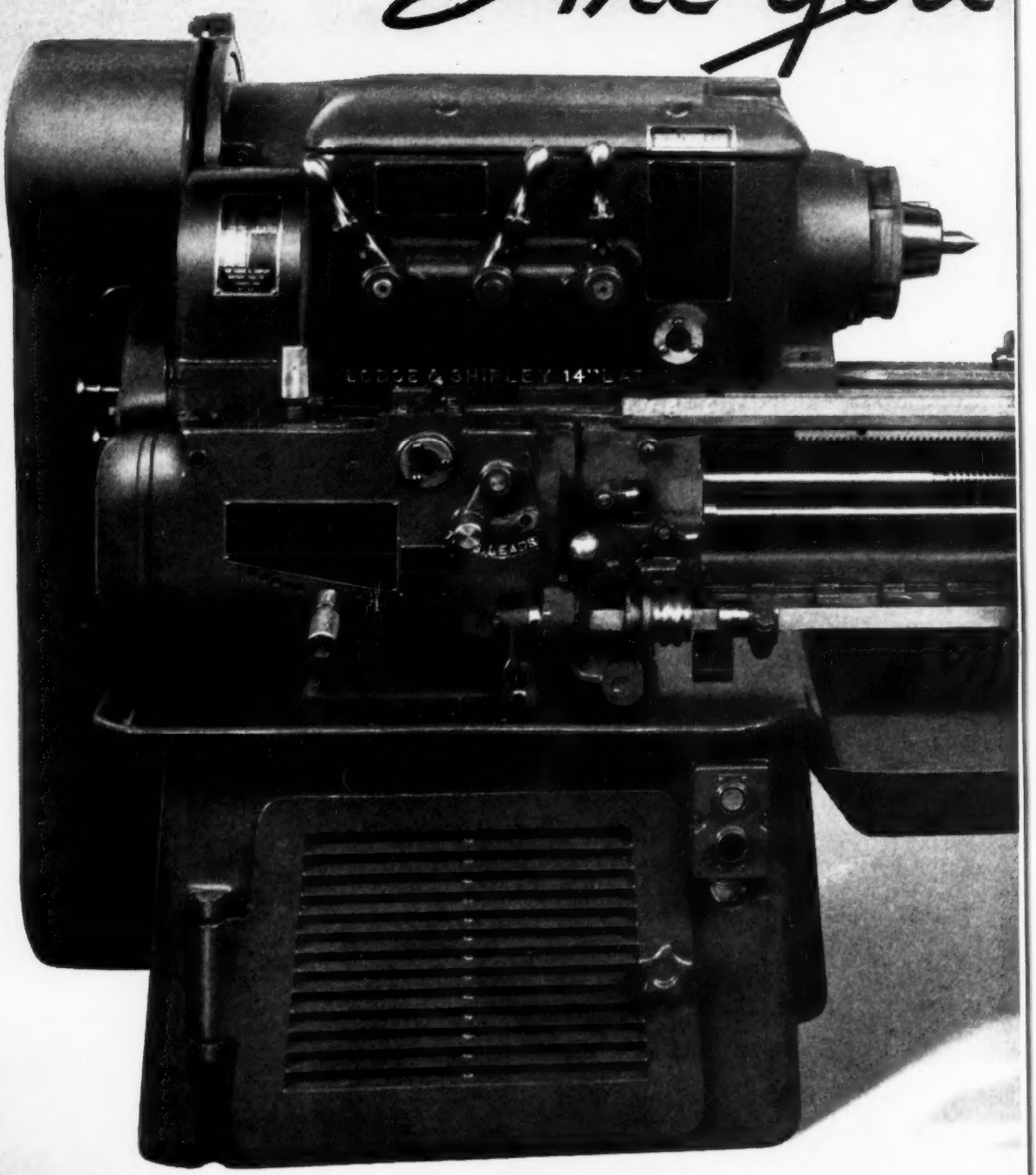

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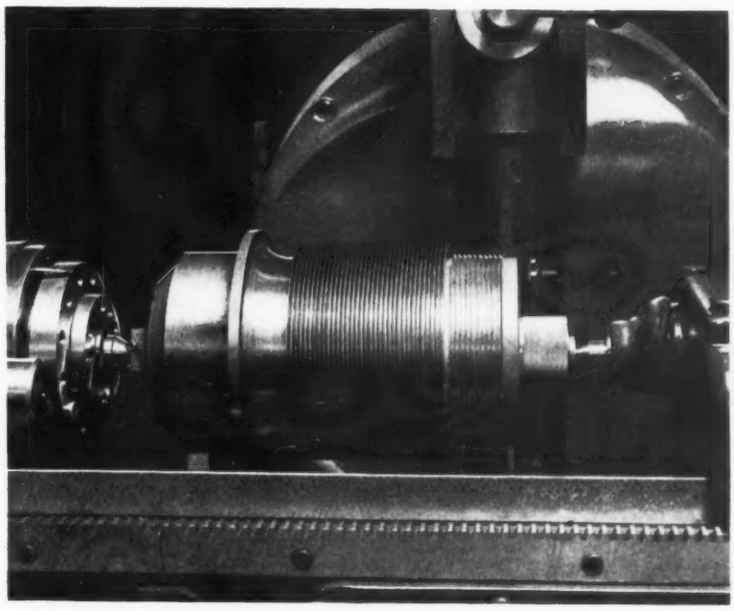
Volume 46 NEW YORK, SEPTEMBER, 1939 Number 1

American Thread-Grinding Practice



A Review of the Principles Applied in the Development of American Thread-Grinding Machines and a Comparison with European Practice

By RALPH E. FLANDERS, President
Jones & Lamson Machine Co., Springfield, Vt.

ABOUT forty years ago, Charles Norton, then with the Brown & Sharpe Mfg. Co., conceived the idea that cylindrical grinding could be developed into a production process. Until that time it had been a toolmaker's expedient for finishing surfaces in hardened parts that could be finished by no other means. As he described it at that time, it was a process by which the toolmaker, clad in an apron and a white collar, sat on a high stool, and in a carefree and leisurely manner, worried the hardened surface into some semblance of accuracy and finish.

It was a long time after the conception of the idea before he was able to build a grinding machine that was capable of production grinding; and it was longer yet before he got the process accepted as a regular machine shop operation. The results we all know. Grinding has become a fast method of sizing—so fast, indeed, that "green grinding," or the bringing to size of diameters before hardening and finish-grinding, is a process of established efficiency.

In its similar sphere, thread grinding has been going through about the same development. For a generation past, threads have been ground when they had to be, but only then. The process was slow and troublesome, and the results only fairly satisfactory from the standpoint of finish and accuracy. It was distinctly in the toolmaking class.

The process of placing thread grinding on a production basis has followed two lines of development. One of them, favored by European practice,

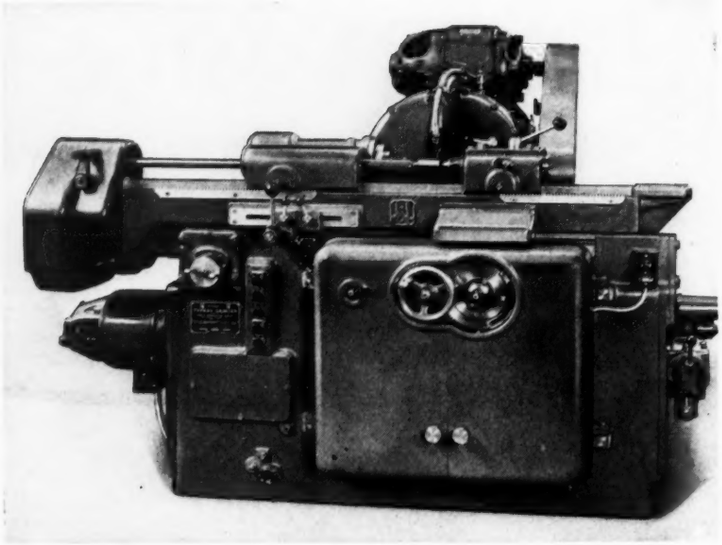


Fig. 1. A Jones & Lamson Production Thread-grinding Machine Providing for Automatic Sizing, as well as Truing, of Grinding Wheel

employs a multi-ribbed wheel. American practice has concentrated, for the most part, on getting the utmost possible production out of a wheel with a single thread contour.

Trend of European Practice in Thread Grinding

In endeavoring to bring the operation to a production basis, the multi-ribbed wheel is the most obvious expedient that presents itself. The wheel is used like a thread-milling hob. If possible, one is provided that covers the whole length of the thread to be produced, so that the work can be finished in one revolution. Two methods of forming the multi-ribbed wheel are used. In one, a hardened roll, provided with ribs of the proper shape and with holes or gashes to make crushing edges, is forced into the wheel, thus breaking down its grains to produce the desired contour. This method is fairly satisfactory for roughing threads, but does not give the accuracy required for much of the work to which thread grinding is applied. It is largely used in Germany and on German machines.

The method preferred in England is that of guiding a formed diamond across the face of the wheel, moving it in and out by a cam or pantographic action as it traverses. By this means, a much more accurate shape can be produced, though the process is somewhat slow.

In either case, owing to the slowness of the process, the tendency is toward the use of comparatively hard wheels which will hold their form for a large number of pieces, so that "time out" for truing will be reduced. This limits the rate of metal removal in European practice, so that full advantage of the multi-ribbed wheel is not obtained.

Development of American Practice

American practice has followed entirely different lines, paralleling some of the elements of cyl-

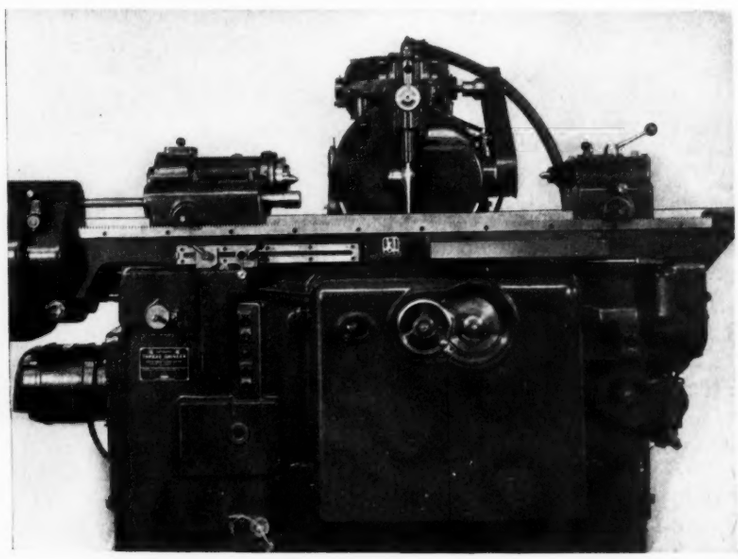


Fig. 2. The Machine Shown in Fig. 1 Provided with Attachments Required for Tool-room Work

Fig. 3. Grinding Threads from the Solid on Heat-treated Parts Faster than These Threads were Formerly Milled before Heat-treatment

indrical production grinding. Particularly important is the use of much softer wheels, giving a fast, free-cutting action. Likewise important is the use of faster work speed, higher wheel speeds, and heavier cuts than in European practice. For the range of heat-treated alloy steels in general use, for instance, 3 to 10 feet per minute work speed; 0.025 inch depth of cut; and wheel speeds of 7000 feet per minute or over are considered good practice. When conditions are right for high production, the sound of the wheel on the work is a soft sound, indicating free-cutting action, light pressures, and a minimum of heating.

Though high wheel speeds are forbidden in some states, they may be used with entire safety if the wheels have been tested for them by the maker, and if they are completely protected by heavy guards when in use.

The critical element in high production by the American method is not the breakdown of the wheel by the dulling of its grains, as in European practice, but the "loading" of the wheel by the rapid removal of metal. To carry the process to its utmost limits, therefore, it is necessary to make wheel truing the focal point of the whole design and operation. The machine must be designed to true automatically and in a few seconds—even between every cut, if necessary, where the unwrapped length of thread is great.

While the machine should be arranged so it can true after every cut, this is necessary only on long threads. For shorter threads, truing before the finish cut is sufficient. On still shorter threads, truing while the work is being changed is satisfactory; while on very short threads, several pieces may be ground with one truing of the wheel.

In this connection, whenever the phrase "length of thread" is used, it is understood to be the unwrapped length of thread; that is to say, if one took a string, held it at the beginning of the thread, and wound it around the groove until he came to the end and cut it off there, the resulting length

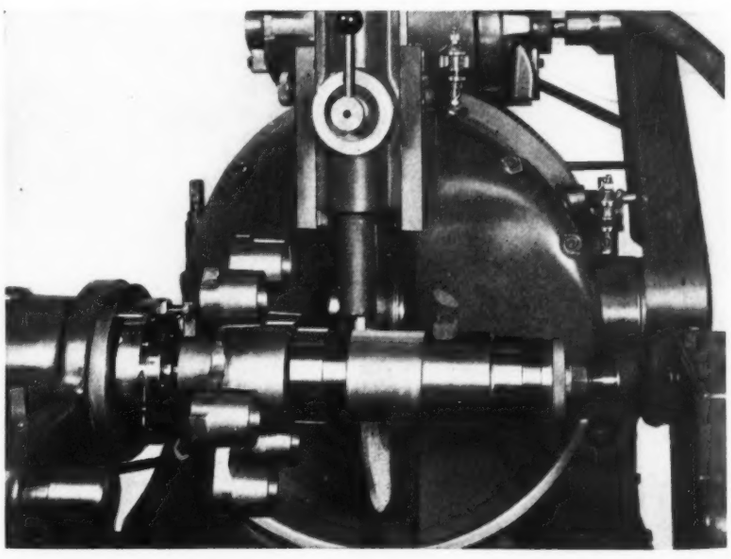


Fig. 4. Aircraft Propeller Shaft Having Threads of Two Diameters Ground at the Same Setting

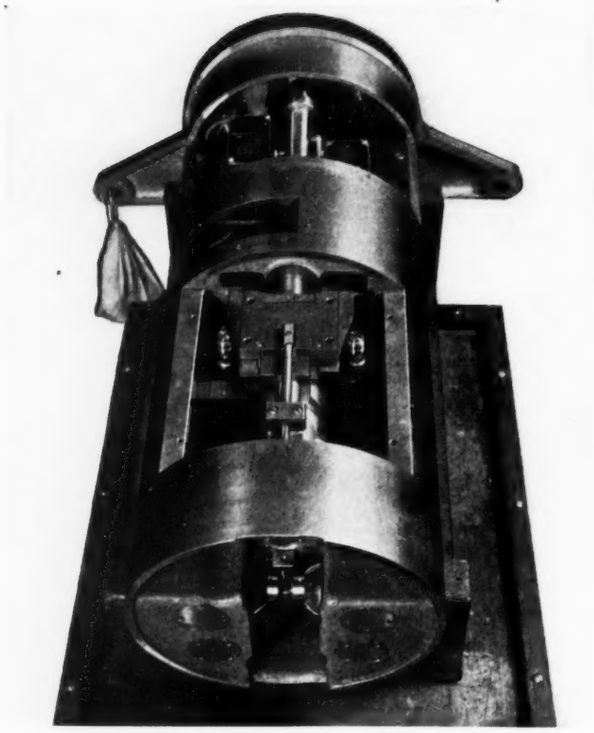


Fig. 5. Universal Truing Device for Thread-grinding Wheel, Removed from the Machine

of the string would be what is termed the "unwrapped length of thread."

Efficiency of Thread-Grinding Process

When the cutting conditions are right, on threads of not too great length, the grinding wheel can remove metal faster in the heat-treated piece than the milling cutter can in the soft piece, with the added advantage of automatic upkeep of the cutting tool, due to the provision of an automatic truing device for the wheel. This is particularly important in those alloys that tend to dull the sharp points of the milling cutter. The grinding wheel is a very inexpensive cutting tool, and does not have to be taken out of the machine to be sharpened. The chips produced are real chips and not dust. They are fine curls which will mat together.

The cheapness of the grinding wheel as a cutting tool should be emphasized. Under proper cutting conditions, it is seldom necessary to remove more than 0.0005 inch in depth from the wheel in truing, and, in the ordinary run of shop work, the wheel has to be trued only once for each piece. Under these conditions, a 20-inch wheel has a life of 5000 pieces *and is sharp and true in form for every one of them.*

Thread-Grinding Machines

In a grinding process that has no mercy on the wheel, it is evident that special provisions must be made for maintaining size, if the machine is to be run by an ordinary machine operator rather than by an expert toolmaker. Automatic sizing, as well as automatic truing, is provided for in the machine shown in Fig. 1. Automatic sizing is accomplished by feeding the wheel toward the work automatically just the amount that the truing device is fed toward the wheel when the latter is given a fresh surface. This keeps the cutting contour of the wheel always at the same distance from the center line of the work when the cross-feed comes against its stop. This solid abutment stop remains unchanged throughout the life of the wheel which, when new, is 20 inches in diameter, and when discarded, 15 inches. The only adjustment that has to be made is for diamond wear. This is not often required, and is easily taken care of by occasional inspection.

Mention has been made of the loading of the wheel as setting the limit of production. Grain, grade, temper, and bond are important in this regard. By close cooperation of wheel manufacturers with machine builders, great progress has been made in fitting the wheel to the work.

Another important line of progress has been made in the development of the proper cutting fluid. While the cooling action of the fluid is of some importance, it is not nearly so important as the ability that certain oils have for preventing the loading of the wheel. Present practice, therefore, tends toward the use of a cutting oil with certain dissolved components that have a special effect in preventing wheel loading. The method of applying the cutting fluid to the point of contact of the wheel with the work is also important in this respect.

The history of the commercial introduction of

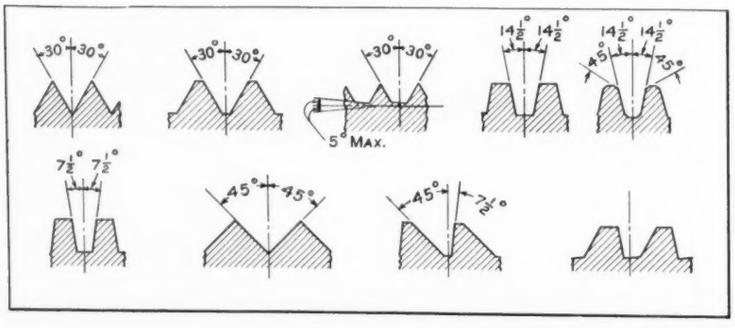


Fig. 6. Thread Forms for which the Wheel can be Trued with the Truing Device Shown in Fig. 5

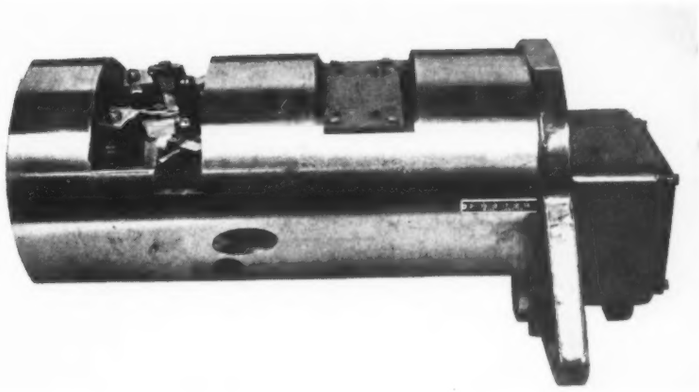


Fig. 7. Pantographic Truing Device for a Thread-grinding Wheel in which Movements of Two Diamonds are Controlled by Two Formers

the machine shown in Fig. 1 is interesting. While designed from the start as a production machine, it was also provided with all the attachments necessary for tool-room work. A machine so equipped is shown in Fig. 2. Should a customer desire it, this machine can be set up to grind a Whitworth form, internal, tapered, spiral-fluted, relieved, no-lead hob.

Thread Grinding as a Commercial Process

At first there was, of course, a lack of appreciation of the possibilities of thread grinding as a commercial process, as distinguished from its use for tool-room work. As expected, therefore, the first machines built were largely used for the grinding of taps, hobs, and similar work. Even so, there was a great increase of output over previous methods of thread grinding. It should be noted, however, that there are no such astonishing production records to be made in the grinding of hardened high-speed steel as in the case of the alloy steels. The work speeds have to be higher and the cuts lighter. Nevertheless, the machine made possible a great advance in output on tool-room work.

In Fig. 3 is shown the first installation applied to the purposes for which the machine was originally designed. This photograph, taken in the plant of an automotive parts builder, shows threads being ground on heat-treated parts faster than they were formerly milled before heat-treating. The success of the first installation led to a duplicate order, and then to further installations for the same kind of work. Thread grinding is now firmly established as a production process.

Truing Devices for Thread-Grinding Wheels

As already stated, the truing device is the heart of the machine. Fig. 5 shows the universal truing device removed from the machine. The two diamonds that trim the sides of the wheel are guided by the rolls running on the formers shown. A third diamond faces the crest of the wheel. The various thread forms shown in Fig. 6 can be trued with this device. Fig. 7 shows the pantographic truing device, in which the movements of two diamonds are controlled by two formers. The thread forms shown in Fig. 8 can be trued with this device. Although threads with rounded contours require more careful attention, the thread-grinding process is perfectly practical and satisfactory for these threads as well.

The net results of the American development of thread grinding are two. One relates to production, and the other to accuracy. In production, the single wheel, continuously re-formed and driven to its limit, has proved to be equal or superior to the European multi-ribbed wheel as a production tool. In accuracy, the continuously sharpened wheel, with automatic sharpening and automatic sizing built into the machine, preserves its shape and diameter throughout the life of the machine, with a minimum of expert attention. In this respect, it greatly surpasses European practice.

No longer need screw threads be left unfinished and inaccurate on hardened and ground pieces. Such pieces can now be provided with accurate ground threads, in most cases at less expense than was formerly required for producing an inaccurate, unground surface.

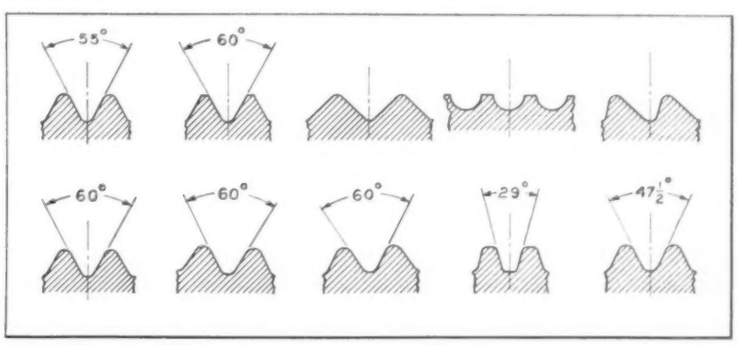


Fig. 8. Thread Forms with Rounded Contours for which the Wheel is Trued by Truing Device in Fig. 7

Die Design and Construction

A Treatise on the Principles Embodied in the Design of Different Types of Sheet-Metal Blanking, Forming, and Drawing Dies—Last of a Series of Articles

By CHARLES R. CORY*

THE present installment of this series of articles, which is a continuation of the preceding article, deals with piercing, cutting-off, and forming dies.

Die Design for Pressure-Pad Forming

Fig. 11 shows two dies designed for pressure-pad forming. A part of the blank is gripped between the punch and a pressure-pad. The pressure-pad is forced to travel with the punch against the pressure of either springs or air-operated pins. While the pressure-pad travels, still gripping the blank, a stationary flanging or forming die forms the blank to the desired shape. This stationary die may be located outside of the pressure-pad, so as to form the edges of the blank, or may operate through a hole in the pressure-pad. The latter action may either emboss a shape in the blank or form a flange around a hole in the blank.

*Die Engineer, Fisher Body Division, General Motors Corporation, Detroit, Mich.

The pressure-pad may be attached to either the die-shoe or the punch-shoe, as shown in the upper and lower views, respectively, of the illustration. It is more commonly attached to the die-shoe, since, in that case, it is easier to remove the finished part by blowing it off with a jet of air or by the operator picking it off the die.

Combination Solid Forming and Pressure-Pad Forming

A part can be formed by a combination of solid and pressure-pad forming. A form is "spanked" in the blank by the punch forcing the blank into a form machined in the pressure-pad. This is the solid forming part of the operation. After this form is produced and the punch has bottomed on the pressure-pad, further punch travel forces the pressure-pad down. During the downward travel, a stationary forming or flanging die on the die-shoe completes the forming of the part. A diagrammatic view of this type of die is shown in Fig. 13.

The spring or air pressure operating the pressure-pad may not be strong enough to support the pressure-pad in an upward position while the punch forms the blank to the shape machined in the top surface of the pressure-pad. In that case, the pressure-pad will be forced down before the blank is formed to the desired shape, and there will be a space greater than the metal thickness between the punch and the pad. This will make the arrangement unsuccessful if the lack of full holding contact between the forming punch and the pressure-pad causes the blank to shift unduly, or results in wrinkling or tearing of the blank during the performance of the forming operation.

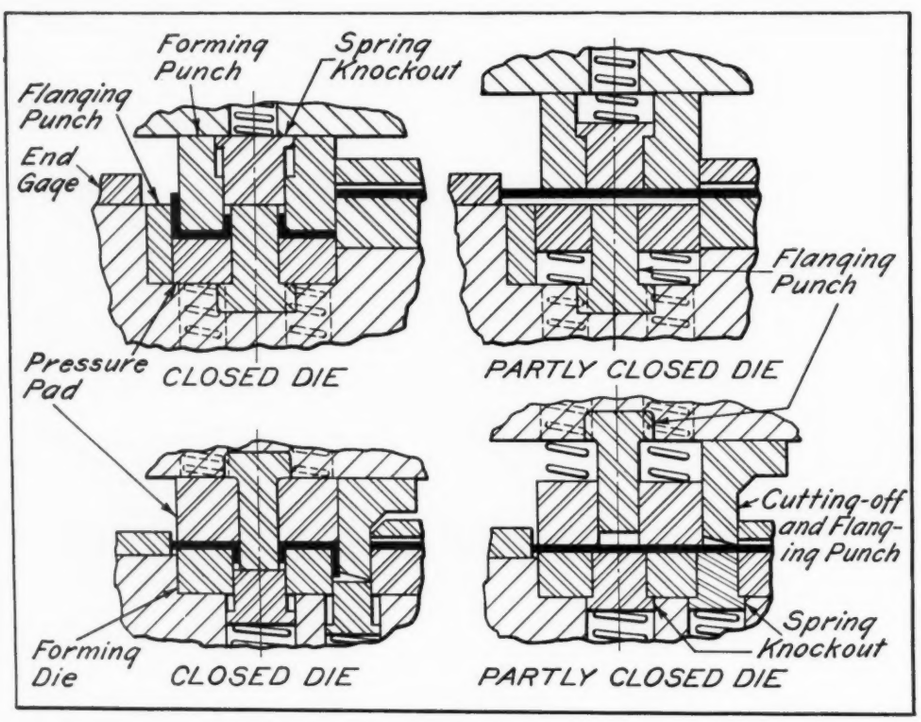


Fig. 11. Pressure-pad Types of Forming Dies

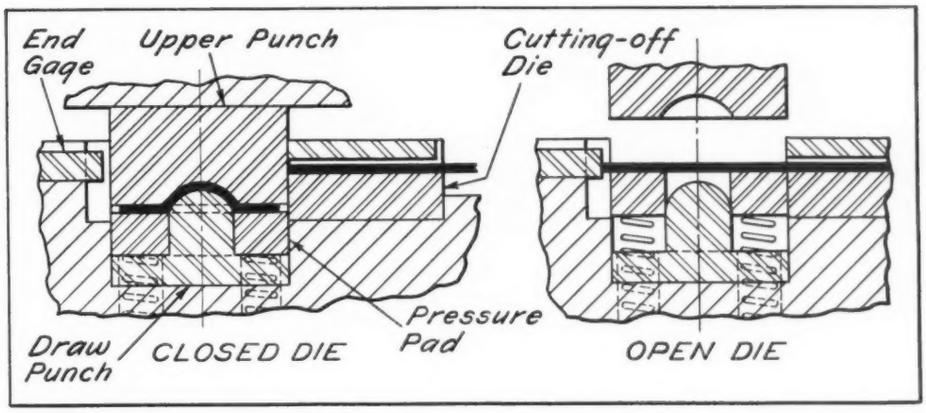


Fig. 12. Cutting-off and Forming Die Designed for Draw Type of Forming

Fig. 12 shows diagrammatically a die for a draw-forming operation. The blank is held around its outside edge by a pressure-pad, which is forced down by the punch. As the pressure-pad travels downward, a stationary draw-punch, operating through a hole in the pressure-pad, forces the blank into the shape machined in the upper punch. This action draws the metal of the blank from between the pressure-pad and the upper punch.

If the extra amount of metal required in changing the blank from a flat shape to the shape desired is small, the blank can be stretched into shape. Then there will not be any drawing of the metal from between the pressure-pad and the punch. Such an operation is called "pressure-pad embossing." The only distinction between it and a draw-forming operation is that the shape of the part is shallow enough so that no metal is drawn over the pressure-pad, since the shape is taken care of by stretching the metal.

A draw-forming die is required if the shape to be formed cannot be produced by either a solid or the ordinary type of pressure-pad forming operation, in which the pressure-pad holds that part of the blank which does not move laterally. It is difficult to give a definite rule as to when a draw-forming die is needed. If there is much "excess" metal at any part of the blank during the forming operation, draw-forming is required. The subject of "excess" metal will be referred to further in a subsequent paragraph.

The disadvantage of a draw-forming die is that the extra metal required for the drawn shape may be pulled in from between the punch and pressure-pad in varying amounts. For one blank, a greater amount may pull in from one side, and, for another blank, a greater amount from another side. The position of the edge of the part is not, therefore, dependable when produced in a draw-forming die.

Different Types of Forming Dies Compared

A solid forming type of die is preferable, if a satisfactory part can be produced by it, in spite of the tendency of the blank to shift sidewise. If this shifting is always in the same direction and the same in amount, it can be compensated for by relocating the gages. The blank is then actually gaged in an offset position, but in such a way that when it shifts it will take the correct position for forming.

The uncertainty of blank-shifting can be reduced by using a spring pin or air-operated pin to hold the blank against the punch, as illustrated in Fig. 14. This pin may be pointed or serrated for better gripping action. It is usually located opposite that part of the die-block which first comes in contact with the blank. The use of a spring pin actually makes the die a modified pressure-pad forming die, since the spring pin is a miniature pressure-pad.

Another weakness of the solid forming die is the possibility of the blank becoming distorted during the forming to such an extent that it cannot be "spanked" to the required shape at the bottom of the press stroke. In difficult cases, the blank may tear if there is too much tension, or wrinkles may be caused if there is excess metal.

When a solid forming die is not satisfactory, a pressure-pad die is used. In this type of die, the blank is prevented from shifting, and that part of

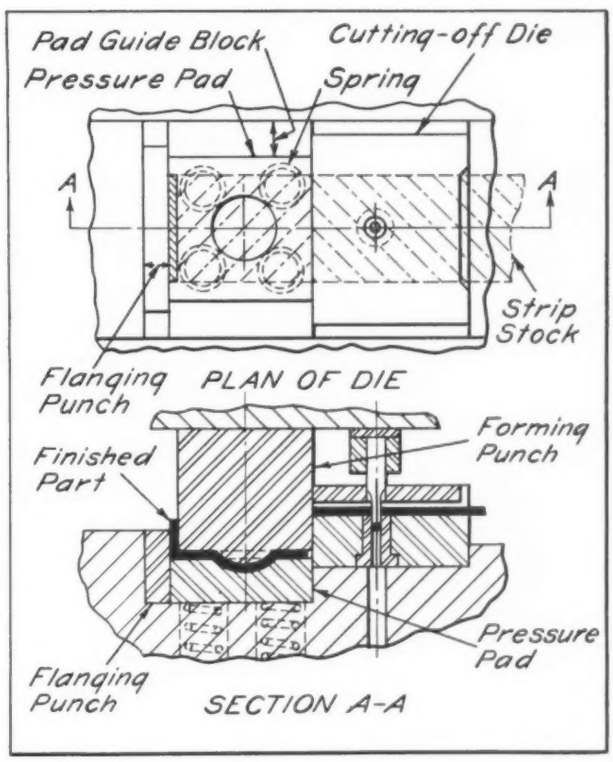


Fig. 13. Piercing, Cutting-off and Forming Die Designed for Combination Solid and Pressure-pad Forming

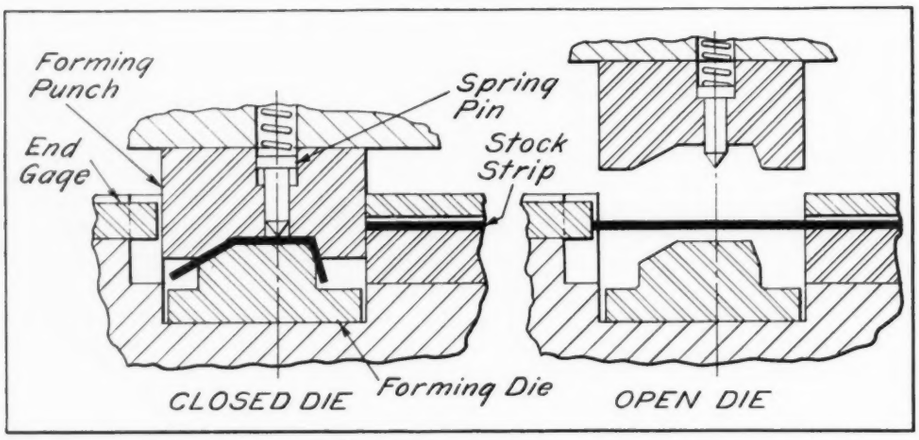


Fig. 14. Diagrams Showing Method of Using Spring Pin in Punch to Prevent Blank from Shifting

the blank which is held by the pressure-pad cannot be distorted by the forming operation on the remainder of the blank.

A draw-forming die is required in cases where the blank would be likely to wrinkle if the part were produced in either a solid or a pressure-pad die. This occurs when the part is of such a shape that the operation produces excess stock at certain points. Excess stock is a by-product of the pulling of metal from the edges of the blank into places where more metal is required as the sheet changes from a flat to a formed surface. In pulling the metal into places where it is actually required, too much metal is sometimes pulled into places where it is not needed. It is this excess of metal that causes wrinkles.

In forming a straight channel of constant cross-sectional shape, there will obviously be no cause for excess metal and no tendency to wrinkle; but if the metal is pulled into a form from a curved "break-line," there may be either excess or deficiency of metal, and it is in cases of that kind, that a draw-forming die becomes necessary, if the tendency to produce wrinkles is marked.

This article concludes the series on die design and construction.

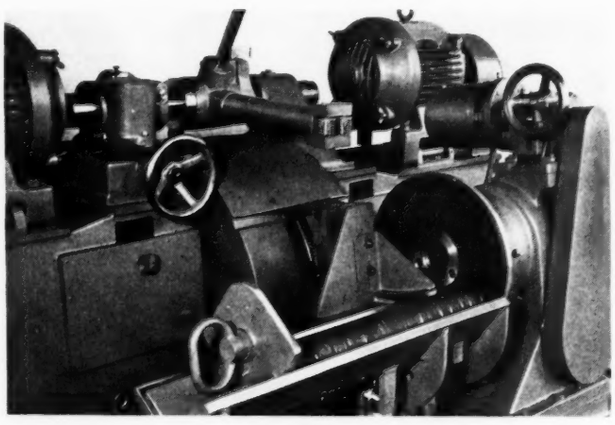
Amending the Wagner Act

A booklet entitled "Why and How the Wagner Act Should be Amended" has been published by the National Association of Manufacturers, 14 W. 49th St., New York City. This is an unusually well considered and unbiased statement. Those who employ and supervise labor, as well as working men themselves, would greatly benefit by a careful reading of this pamphlet, which clearly outlines the problem and asks the pertinent question whether, in these United States, there should be equality before the law, irrespective of the status of a man or woman as an employer or as an employe.

* * *

Telling Employes How Money is Spent

The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., gives its employes a detailed account of how every dollar taken in by the company is spent. In 1938, of every dollar received by the company, 42 cents went for wages and 28.7 cents for materials and supplies. These two items alone accounted for 70.7 cents. Of the remainder, 2.9 cents went for employe benefits, annuities, and group insurance; 5 cents for advertising and sales expense; 2 cents for rent, insurance, power, etc.; 1.9 cents for patents, royalties, and office expenses; and 2.8 cents for transportation. The tax collector took 4.5 cents of every dollar, and 4.7 cents was required to provide for depreciation; 1.3 cents was set aside as surplus, and the stockholders received 4.2 cents in dividends.



An Automatic Piston-ring Grinding Machine that was Exhibited by the Diskus Werke at the Leipzig Fair Early in the Year, Designed for Grinding the Sides of up to 2000 Piston-rings an Hour, with an Accuracy of 0.0004 Inch. Note the Welded Construction Embodied in the Design

Producing Precision Gears in a Machine Tool Plant

Methods by which the Cincinnati Milling Machine Co. has been Able to Produce Gears for the Machines of the Company's Manufacture that have Given Unusually Satisfactory Service

By D. STRAUCHEN
General Superintendent, Cincinnati Milling Machine Co.
Cincinnati, Ohio

WHEN a machine tool builder seldom has calls for service on the spindle drive gears of his machines and receives no complaints about noisy gears, even with spindle speeds as high as 1500 R.P.M., the methods used in manufacturing these gears must be such as to be of interest and value to the mechanical field generally. It is for that reason that the methods used in gear manufacture by the Cincinnati Milling Machine Co. are described here.

The manufacture of good gears must start with the raw material. High-grade alloy steels—nickel and chrome-nickel steels—with a very definite grain size and close-controlled carbon are used for these gears, because the strength and toughness of these steels can be brought out at comparatively low hardening temperatures. This, in turn, reduces distortion in heat-treatment to a minimum. Furthermore, the strength and toughness are retained by these steels when hard enough to provide a good wearing surface for the gear teeth.

Both forgings and bar stock are used, depending on the purpose for which the gears are made. The bar stock is purchased in a normalized condition—that is, with a refined and uniform grain structure. Every individual bar is tested for carbon content in the company's laboratory; 10 per cent of the bars are tested for complete composition and the micro structure is examined.

The same procedure is followed in the case of forgings, except that the normalizing treatment is given in the company's own shop before the tests are made. In the normalizing process, the forgings are heated in an electric furnace to a temperature just above the upper critical range, and this temperature is maintained for about five hours. The forgings are then cooled slowly at a definite rate in the furnace. This process insures a uniform hardness of from 187 to 207 Brinell and also refines the grain structure.

With the steel in the proper condition, the machining of the gear blanks can proceed. After the usual operations of turning, and boring and reaming the hole, the blank is ready for cutting the teeth. All machines used for gear-cutting operate on the generating principle, and are carefully maintained in

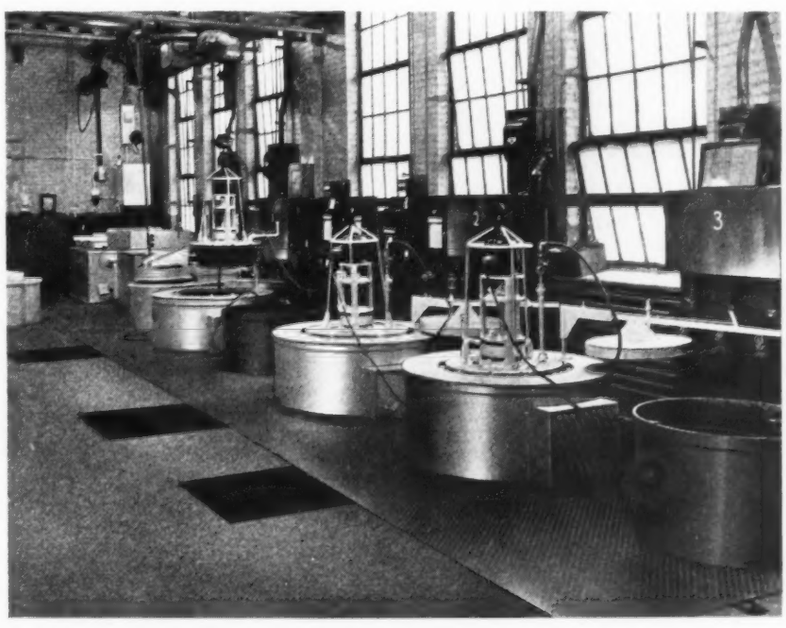


Fig. 1. Electric Furnaces in which the Gears are Heated for Hardening

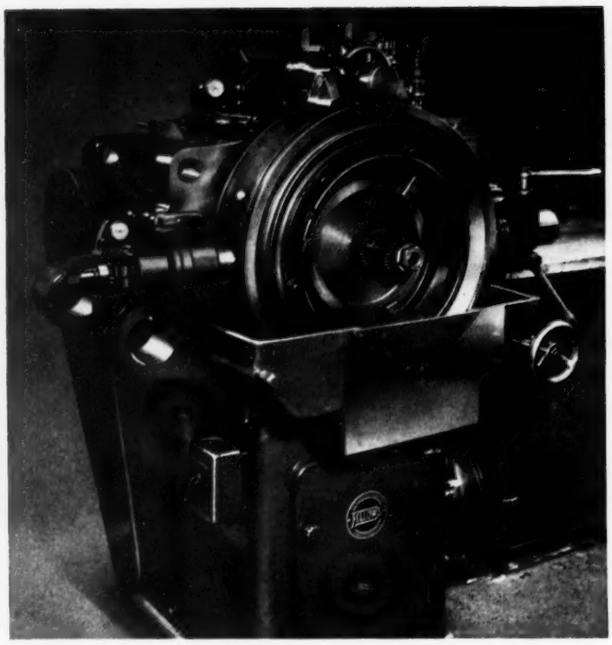


Fig. 2. Gears that are Not Ground are Lapped to Obtain a Smooth Polished Surface on the Teeth

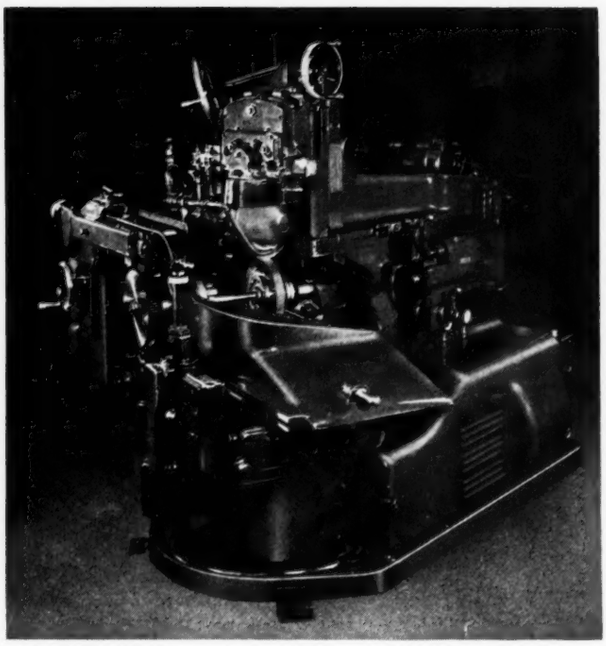


Fig. 3. Grinding Gears, in Order to Produce the Correct Involute Curve and Tooth Spacing

first-class mechanical condition. The work-arbors are adjusted to run dead true for every set-up. Only hardened and ground collars are used, and ample supports are provided to prevent any deflection during the cutting operation. Roughing and finishing cuts are always taken in separate set-ups, using very fine feeds for the finishing cuts.

The next step is the heat-treatment. All heating is done in electric furnaces (Fig. 1). Gas carburizing methods are used exclusively on those gears requiring carburizing. For hardening, the gears are heated slightly above the upper critical temperature of the steel in a non-oxidizing gas atmosphere. The gas is circulated by forced draft, so that it is brought into intimate contact with every square inch of the charge in the furnace, and a uniform condition exists throughout the furnace. By this method, the formation of scale is eliminated, as well as surface decarburization and pitting. No subsequent cleaning operation is required.

The gears are quenched in oil and drawn to a temperature that will give them the hardness specified, depending upon the operating requirements of the gears. After cooling in the air, every gear is inspected for hardness, and occasional gears are tested for strength and grain structure.

After hardening, the final machining operations are performed. First, the gear is chucked on its pitch diameter in a pin chuck and the bore ground. In the same chucking, one face is also ground so that it is truly square with the bore. The second face is ground parallel with this face in a separate operation.

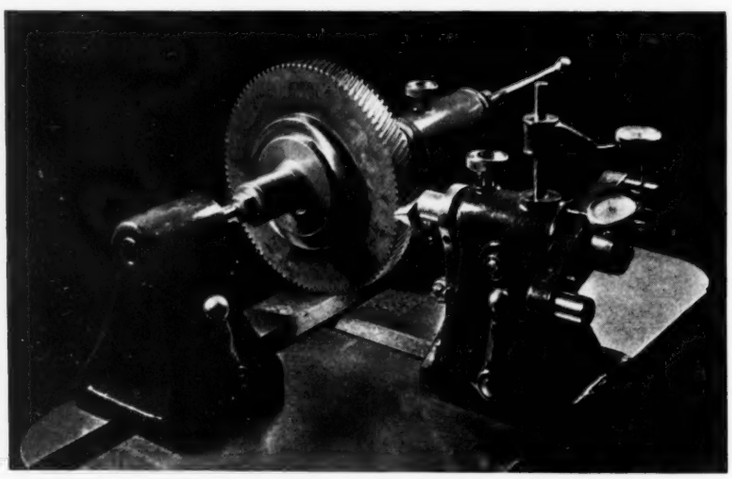


Fig. 4. Machine for Testing Tooth Spacing, Concentricity, and Helix Angle

For finishing the gear teeth, two methods are used which have proved equally satisfactory—grinding and lapping. The machines used for this step in the process operate on the generating principle to insure correct form and spacing of the teeth, as well as concentricity of the gear.

The lapping method is used for obtaining a fine smooth surface on gears that have been accurately formed by the finish-hobbing cut. It is used on gears that can be heat-treated with very slight distortion of the teeth, as well as on some of the less important

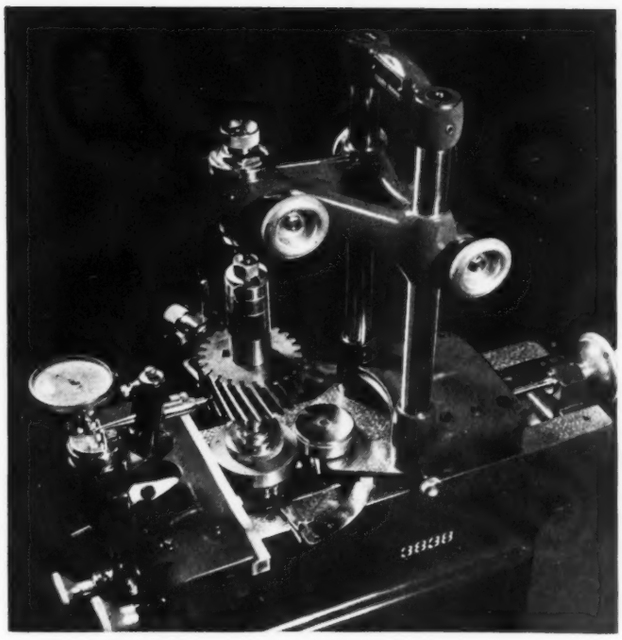


Fig. 5. Involute Testing Machine for Checking the Tooth Contour to Very Close Limits

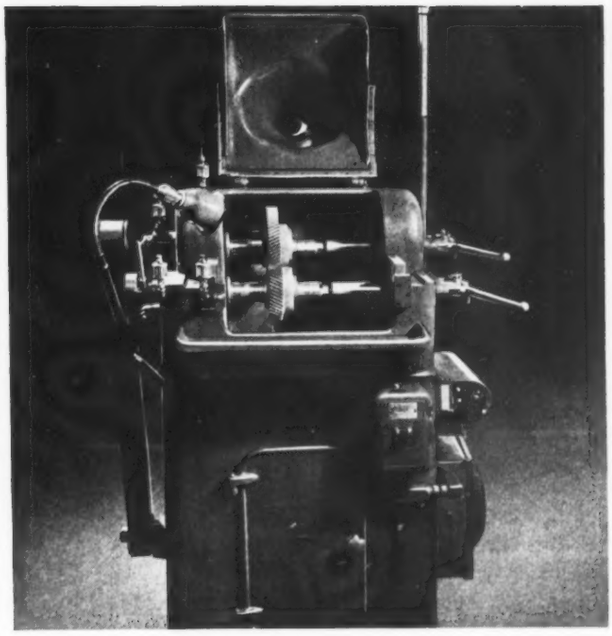


Fig. 6. The Final Testing of the Gears for Noise is Accomplished on This Machine

gears, where the accuracy of the tooth form does not have to be carried to the closest limits, but where a good wearing surface is important.

This lapping is performed on the Fellows machine shown in Fig. 2. The gear is mounted on the spindle, which reciprocates as it drives the lap. The lap itself is a cast-iron internal gear with accurately generated teeth. The lapping compound, consisting of 280 grain Carborundum suspended in oil, is pumped on the work. The hard particles become embedded in the cast-iron lap, thus presenting minute cutting edges which remove irregularities and polish the contacting surfaces in the steel gear being finished.

Gears having more metal to remove than can conveniently be done by lapping are ground. On such gears, from 0.010 to 0.012 inch of stock is left on the gear teeth in the hobbing operation. The grinding is done on the Pratt & Whitney gear-tooth grinding machine shown in Fig. 3. This machine operates on the basic rack and master gear principle, thus assuring a correct involute curve. As this process is one of generating, the resulting surface is actually a series of minute flats. These are too small to cause ordinary gear noise, but if the gear is run at a very high speed, a high pitched "sing" is produced that is objectionable. This can be removed by lapping the gear for a short period of time after grinding.

Inspection of the gears is carried on continuously during the grinding and lapping operations on testing machines, two of which are shown in Figs. 4 and 5. The National machine shown in Fig. 4 is used for testing tooth spacing, concentricity, depth of teeth, parallelism, and in the case of helical gears, the helix angle. The Illinois involute testing machine shown in Fig. 5 checks the tooth contour within very precise limits.

Finally, the gears are tested for noise in the National gear-testing machine shown in Fig. 6. In this machine, each gear is run with its mating gear under load at the speed or speeds at which the gears will run in the machine in which they are to

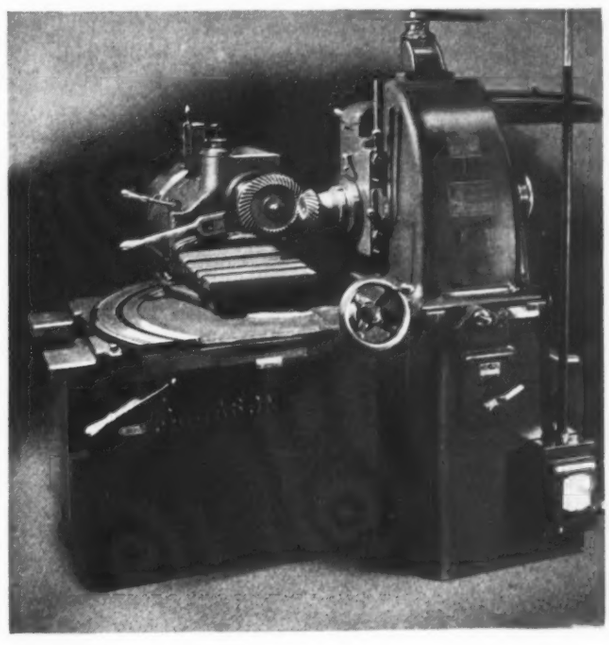


Fig. 7. Universal Gear-tester for Bevel and Worm Gears

be used. This machine must be used by a skilled inspector. It measures nothing —but to an understanding ear it reveals defects that are almost unmeasurable. This has actually proved to be the best test of how a gear is going to perform when it is finally put under load in a machine. If the gears pass this test for noise, they are wired together in sets and sent to the assembly department.

Bevel and worm gears are inspected in much the same way as spur and spiral gears, by using the Gleason universal gear-tester shown in Fig. 7. Fig. 8 shows another Gleason machine that has been found useful for many purposes. It can be used for checking gear sizes, as a sound tester, and as a gear-tooth lapping machine.

New machines and equipment are continually being added to further improve the methods of manufacture and the quality of the gears. Recently, shaving machines were added for the machining of spur and helical gears. Duplicate equipment, consisting of a spiral-bevel generator, lapping machine, spiral-bevel cutter-grinding machine, cutter-testing machine, hardening press, spacing and concentricity tester for bevel gears, together with complete tools, has been obtained for the manufacture of spiral-bevel gears.

These, briefly, are the methods and the equipment used by the Cincinnati Milling Machine Co. for producing gears that have been found to give very satisfactory service in the machines that the company builds.

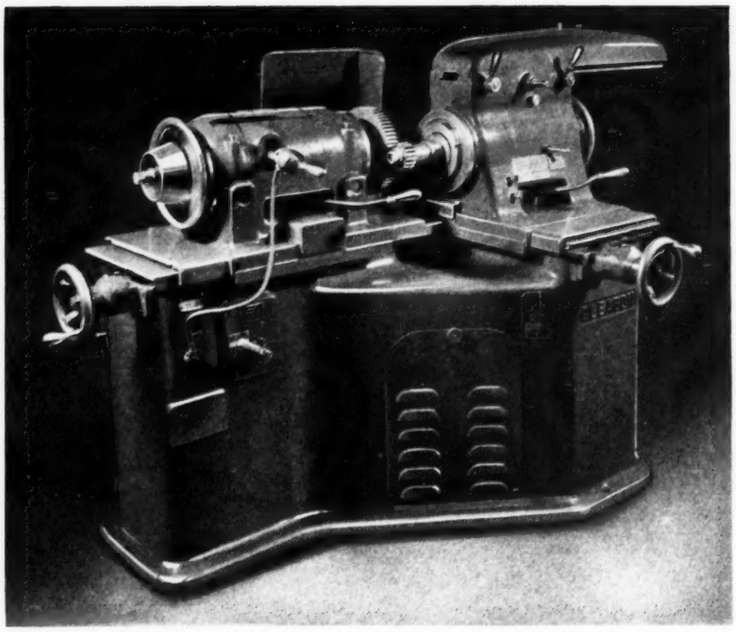


Fig. 8. A General Utility Machine that has been Found Useful in Gear Manufacture. It can be Used as a Sound Tester and Gear-tooth Lapping Machine

* * *

The Part of Industrial Machinery in Social Progress

A booklet entitled "Machinery's Part in Future Social Progress" has been published by Allen W. Rucker, in collaboration with N. W. Pickering, president of the Farrel-Birmingham Co., Inc., Ansonia, Conn. This booklet points out that the present wave of anti-machine propaganda, which claims that unemployment is caused by engineering developments involving the increased use of machinery, is based on erroneous assumptions.

The book deals in detail with the several fallacies underlying the claims of the anti-machine propaganda. It shows how the displacement of labor by machines has been more than counterbalanced by the increasing demand for labor because of machine production.

During the last ten years the standard of living in the United States, instead of advancing, has been retarded; and much of this retardation has been due to lack of appreciation of the important part played by industry and industrial machinery in providing for a more abundant living. Only the economic and industrial ignorance of a large part of the people of the United States in all walks of life has made it possible for depression conditions to continue for so long a period of time, because ample mechanical facilities are available to provide the necessities and comforts that the entire population desires.

* * *

Engineers Celebrate Centennial of Birth of Robert Henry Thurston

The centennial of the birth of Robert Henry Thurston, the great pioneer in engineering education and first president of the American Society of Mechanical Engineers, will be celebrated on October 25 at Ithaca, N. Y., by Cornell University, in cooperation with the American Society of Mechanical Engineers. Delegates from engineering schools, technical societies in this country and abroad, and other organizations will be present.

The celebration will include an exhibit of Dr. Thurston's publications and of the laboratory apparatus he designed. At the memorial ceremony, to be held in Bailey Hall, which will be presided over by Dr. Edmund Ezra Day, president of Cornell University, addresses will be made by Dr. James Pickwell Adams, vice-president of Brown University; Admiral Wilson Brown, superintendent of the United States Naval Academy; Dr. Harvey N. Davis, president of Stevens Institute of Technology; Dr. William Frederick Durand, emeritus professor of mechanical engineering, Leland-Stanford University; and Dean S. C. Hollister, College of Engineering, Cornell University.

The Cleveland Exposition and the Machine Tool Congress

THE Machine Tool Show to be held in Cleveland, Ohio, October 4 to 13, under the auspices of the National Machine Tool Builders' Association, as previously announced in MACHINERY, gives every promise of being the most important exhibition of machine tools ever held in America, if not in the world. There will be about 200 exhibitors, occupying 150,000 square feet of space, some exhibits covering as much as 4000 square feet. Eighty-five per cent of the exhibit space will be devoted entirely to machine tools, while the remainder will be used by the makers of accessories and small tools. In order to limit the attendance to those genuinely interested in the exhibits, there will be a registration fee of $1 per person.

"The last four years," says Wendell E. Whipp, president of the National Machine Tool Builders' Association and president of the Monarch Machine Tool Co., Sidney, Ohio, "have shown substantial advances in the art of machine tool building—advances that mean production costs, increased productivity per dollar invested, and greater potential profits.

"This year's show is purely a business proposition. The registration fee is charged simply to confine the attendance to people that have a direct dollars-and-cents interest in better machine tool equipment, and to minimize congestion."

Program for the Machine Tool Congress

In conjunction with the Machine Tool Exposition, a Machine Tool Congress will be held in Cleveland, in which a large number of national engineering societies and manufacturing associations will participate.

On Wednesday, October 4, at 8 P.M., the National Electric Manufacturers Association will meet at the Hotel Cleveland. On Thursday, October 5, at 8 P.M., the Machine Shop Practice Division of the American Society of Mechanical Engineers will meet in the Hotel Cleveland ballroom. Professor A. G. Christie, president of the Society, will preside at the meeting and will give an introductory address. Two papers dealing with machine tool frames and beds will be read. Frank J. Dost, of the Sterling Foundry Co., Wellington, Ohio, will speak on "Making Better Machine Tool Castings;" Fred Volz, of the Lakeside Bridge & Steel Co., Milwaukee, Wis., will speak on "Welded Frames for Machine Tools."

The American Society of Tool Engineers will hold a meeting in the quarters of the Cleveland Engineering Society at Guildhall at 8 P.M., October 5, while on the same day, the General Electric Institute will have open house and a lighting demonstration at Nela Park from 7:30 to 10 P.M. The Tool Engineers will also hold a dinner meeting at the Hotel Statler, Friday, October 6.

Programs for the Meetings of the Tool Engineers

At the Thursday evening meeting of the American Society of Tool Engineers, three papers will be presented. Stanley R. Thomas, chief engineer of the Bantam Bearings Corporation, South Bend, Ind., will present a paper on "Application and Use of Anti-Friction Bearings as Applied to Machine Tools." Eugene Bouton, supervisor of time study, J. I. Case Tractor Works, Racine, Wis., will read a paper on "Application and Use of Plain Bearings as Applied to Machine Tools." Karl L. Hermann, of South Bend, Ind., will deal with the subject "Bearings—Their Use and Misuse."

At the Friday dinner meeting, at which James R. Weaver, president of the Society will preside, the second report of the Fact-Finding Committee on "Effect of the Development of the Machine on Employment and Our Standard of Living" will be presented by John R. Younger, professor of the department of industrial engineering at the Ohio State University, who is chairman of the committee. An address on "The Economic and Political Effect on the Development of the Machine" will be presented by the Honorable Hamilton Fish, member of the United States Congress.

On Friday, October 6, at 8 P.M., the National Association of Foremen will hold a meeting in the Music Hall of the Cleveland Public Auditorium. On Monday, October 9, the American Foundrymen's Association will hold a dinner meeting in the Hotel Hollenden at 6:30 P.M. and a symposium on castings at 8 P.M. On the same day, the Associated Machine Tool Dealers of America will hold a dinner meeting in the Hotel Cleveland ball-room at 6:30 P.M.

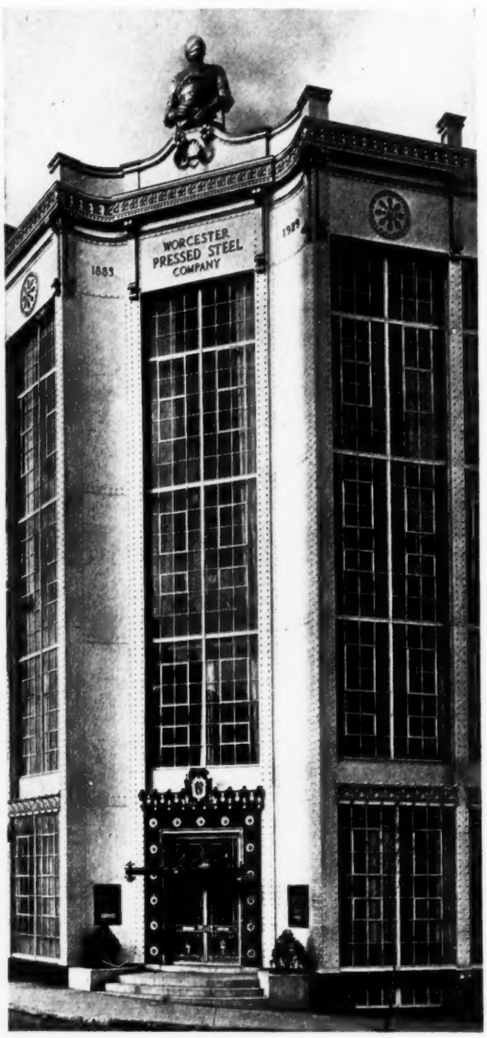
On Tuesday, October 10, at 8 P.M., the Machine Design Division of the Cleveland Engineering Society will meet in the Music Hall of the Cleveland Public Auditorium. The Society of Automotive Engineers will hold a dinner meeting in the Hotel Cleveland at 6:30 P.M., Wednesday, October 11. At this meeting, J. B. Geschelin, Detroit editor of *Automotive Industries*, will present an address entitled "A Trip through the Machine Tool Show." F. E. Crawford, president of the Thompson Products Co. and of the Cleveland Chamber of Commerce, will address the meeting on "Machine Tools in Modern Industry."

The Industrial Museum

Its Importance and Possibilities

By JOHN W. HIGGINS, President
Worcester Pressed Steel Co., Worcester, Mass.

IN the past, American manufacturers have been so busy developing new products and perfecting methods for their manufacture that they have failed to realize the importance of providing a permanent record of the achievements of their special industry in what might be called a visual and easily comprehensible form, available to the public at large. A manufacturing plant that has made a place for itself in industry should also have its own craft museum. A lawyer accumulates documents in his library; a surgeon preserves specimens in his laboratory; why should not the manufacturer of buttons or dirigibles assemble his collection of exhibits, illustrating the service and recording the history of his special line of manufacture? By so doing, he would surround himself and his associates with a friendly atmosphere that would germinate creative ideas.



An industrial museum of this type has been established at the plant of the Worcester Pressed Steel Co., the exhibits for which have been collected and arranged over a period of years. The museum includes an exhibition, a library, and a laboratory of pressed-steel products, collected from all over the world and representing every period in history. This museum has been established with five definite purposes in view: (1) To inspire those engaged in steel-working in the plant; (2) to attract superior young men into the industry; (3) to stimulate Art in Industry; (4) to give due credit to the craftsmanship of the individual steel-worker; and (5) to inform the public of the purposes, methods, and working conditions of that particular plant.

This collection of steel products is housed in a steel and glass building of attractive design, adjoining the works. One wing of the museum is devoted to modern products, headed by that outstanding masterpiece of modern mass production—the automobile—which is composed 90 per cent of pressed steel. There are glass cases that display stamped, cold-forged, and deep-drawn steel parts for every conceivable industry. Here is a visual history of the development of steel, from the iron ore through the various stages of raw materials to the finished product. Other exhibits show the dies and punches used in the mass production of stampings. There is no partiality in the display of the products. Stampings made by other manufacturers are displayed side by side with those of the Worcester Pressed Steel Co., and labels are provided giving the manufacturer's name.

Then there is a wing devoted to the ancient art of the steel-maker and displaying the products of the medieval era. This wing is headed by a group of sixteenth-century armored knights, mounted on their horses, all in full steel panoply. Many masterpieces of the armorer's art are shown, and scores of different types of weapons, tools, and utensils.

The main floor of the museum is devoted to the products of the steel age, but a gallery contains implements and products of the stone age and of the bronze age, including Greek and Roman armor, and war weapons and tools of the early iron age.

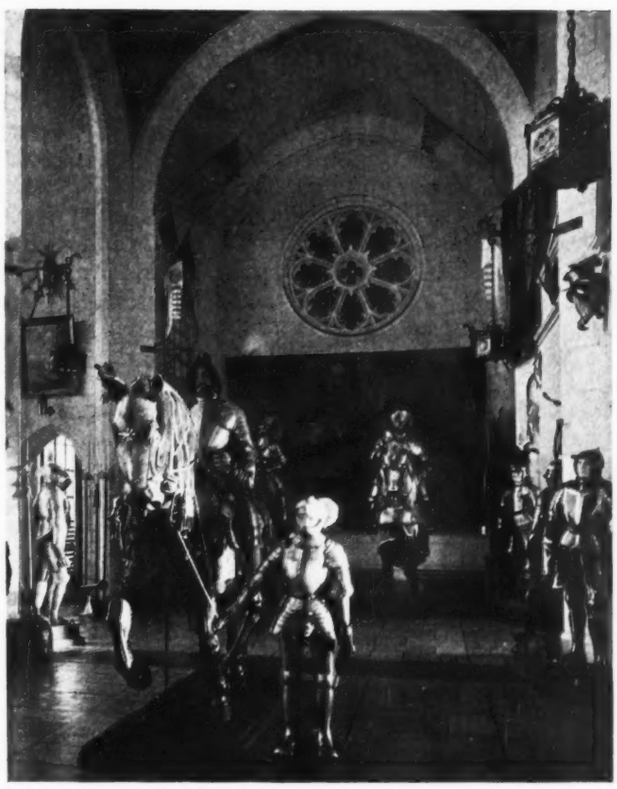
The doors of the museum are open to the public from 8 A.M. to 5 P.M. daily, except Saturdays, Sundays, and holidays. The exhibits have attracted

an attendance of 10,000 visitors a year, since the opening ten years ago; just as the mill and shop buildings are open to visitors, so the museum galleries are open to the shopworkers.

Here the worker may see the value of his own effort in the finished construction and recognize his own relation to the onward march of industry. He can compare the products of today with the masterpieces of the past. He can also compare his tools, his wages, and his comforts with those of his predecessors, in this his chosen line of work. He is enabled to form a correct estimate of the past, evaluate the present, and catch a glimpse of the future.

Casual observers, recognizing that modern craftsmen produce work excelling in accuracy, efficiency, uniformity, durability, lightness, and low cost through mass production, overlook that they fail in comparison with the masters of the past in the quality of artistic design. Museums of this character are a valuable means of comparison and materially assist in stimulating the sense of beauty that ancient craftsmen possessed. There is no reason why all products cannot be beautiful, as well as useful. Many mass products express the highest qualities of art and beauty, and yet function perfectly for the purpose for which they are intended.

Display of Pressed-steel Products in One Wing of the Museum



Part of Wing Devoted to the Ancient Art of the Steel-maker, Displaying the Products of the Medieval Era

* * *

Inventors to be Honored by Manufacturers

The National Association of Manufacturers, 14 W. 49th St., New York City, is planning for a nation-wide observation of "Modern Pioneers' Day" to celebrate the one hundred and fiftieth anniversary of the origin of the American patent system. In this connection, the Association plans to honor inventors and research workers who have contributed to the advance of the standard of living. Definite dates and plans for the celebration have not yet been announced, but it is expected that the events will take place in October. Industrial firms are invited to submit names of inventors and research workers who have developed products and processes that have contributed to American progress.

Engineering News Flashes

The World Over

New Type of Airplane Completed in England

The first of what is said to be a revolutionary type of commercial air liner, which will fly at altitudes much higher than were formerly practicable, and which will span the distance between England and Australia with only three stops, reaching South Africa with only one stop, was recently completed at Rochester, Kent, England. These new air liners will have a range of well over 3000 miles, and will fly at a height of more than 30,000 feet. The planes are four-engined monoplanes, capable of a speed of over 330 miles an hour, with a normal cruising speed of 285 miles an hour. These planes inaugurate a new phase in aircraft transportation.

Indicator Showing Variations in Thickness of a Millionth Inch

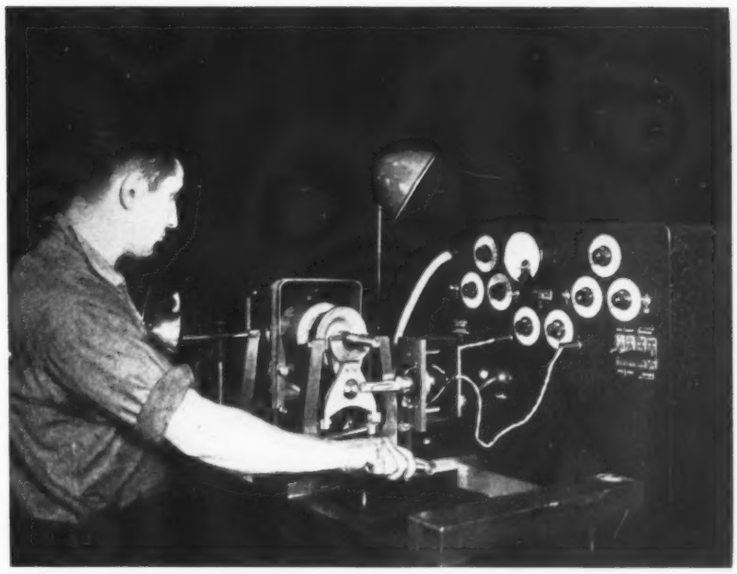
A device so sensitive that it will indicate the differences in the thickness of a finger-print on a piece of smooth glass has been developed by J. A. Sams, of the General Electric Laboratory at Schenectady, N. Y. Known as a "surface indicator," the instrument is used to determine the smoothness of metal or painted surfaces. It indicates minute variations far beyond the range of the human eye. Variations as small as one-millionth of an inch are clearly indicated. Surfaces of bearings, for example, that are subject to wear can be tested by this instrument and their smoothness indicated.

The apparatus has an appearance somewhat like that of a phonograph with its turntable, on which is placed the object to be tested. A sapphire-pointed stylus or needle passes over the test material as it revolves. The mechanical impulses created as the hard point rides over the surface irregularities are converted into electrical impulses, which are amplified and transmitted to a recording meter, where they are graphically indicated. The instrument is so sensitive that when the needle is placed on the revolving metal turntable, the invisible vibrations created by a person whistling are shown by the recording meter.

Diesel Engines Easily Converted to Operate on Natural Gas

A natural gas conversion method which can be used on all six-cylinder, 125-H.P., Diesel engines has been developed by the Caterpillar Tractor Co., Peoria, Ill. The outstanding feature of this conversion method is its simplicity. The entire process of converting the engine from oil to natural gas takes about four hours, and, if necessary, this work can be done in the field. The Diesel cylinder head is removed, and with it the injection valves and lines. It is replaced by a special head, the compression lowered, and spark plugs provided. The

An Indication of the Extent to which Ball and Roller Bearings are Now being Used in Machine Tools may be Had from a Study of the Accompanying Illustration, which Shows the Ball and Roller Bearings Employed in a Single Warner & Swasey Average-size Turret Lathe



Dynamic Balancing Machine Devised by Westinghouse Engineers to Measure the Unbalance of Rotors Quickly and Accurately, Reducing the Once Complicated Problem of Balancing, with its Involved Calculations, to a Simple Reading of Meters. This Machine is Shown in the Westinghouse Exhibit at the New York World's Fair

Diesel fuel injection pumps are also replaced by a magneto, and a carburetor is added in the intake air line. The conversion parts are carried in a specially constructed box, partitioned to hold all the replaced parts and give them clean storage space when not in use.

United States Forges Ahead as a Shipbuilding Nation

According to the statistics published by Lloyds Register of Shipping, covering merchant ships under construction at the end of the first quarter of the present year, the United States, for the first time in many years, occupies the second place among the world's shipbuilding nations, ranking next to Great Britain. The total tonnage under construction in the United States on March 31 was 420,931. Germany, Japan, and Holland follow, in the order mentioned. Among the ships being built in the world's shipyards at the present time, there are four steamers exceeding 30,000 tons, two steamers and two motor ships between 20,000 and 30,000 tons, and thirteen steamers and forty-two motor ships between 10,000 and 20,000 tons.

Recently Developed Device Measures Rotor Unbalance at World's Fair

In the exhibit of the Westinghouse Electric & Mfg. Co. at the New York World's Fair, a machine developed for accurately measuring the unbalance that causes vibration of rotating parts is featured.

The equipment operates briefly as follows: A rotor is mounted on flexible supports. This rotor is driven by a small motor at a constant speed. Voltages proportional to the vibrations of the two pedestals supporting the rotor ends are obtained by the device. These voltages are combined to give two voltages, one proportional to the unbalance at one end of the rotor and one to the unbalance at the other end. The amount of each voltage is metered, and the phase angles of these voltages with respect to the rotor position are also measured by the device, in order to locate the unbalance.

The two voltages created by the unbalance in each rotor are put into a circuit which acts as a calculating machine, giving answers proportional to the unbalance. The calculating device gives the solution for two simultaneous vector equations. The phase angle of the unbalance is obtained by having each of these voltages trip a stroboscopic lamp, which illuminates the rotor and shows, opposite a pointer, the position of the unbalance in question.

In its various forms, the balancer is as applicable to a rotor for a vacuum cleaner as to one for the largest turbines. Rotors have been balanced at speeds as high as 10,000 R.P.M. The machine is accurate far beyond commercial requirements. It will indicate 0.001 ounce-inch unbalance at one correction plane on a rotor 2 inches in diameter and 2 inches long.

British Inventor Claims to have Found a Substitute for Gasoline

A patent has been obtained by a Liverpool, England, engineer, Thomas David Jones, who, after long research and experimentation, claims to have found a substitute for gasoline, which will cost only four cents a gallon when produced in large quantities. The process, not described in detail, is said to "reverse the usual method of extracting and refining fuel oils, and consists of building up light gases and liquids which gasify at ordinary temperatures." Automobile engineers, after testing the new fuel in a car driving a distance of 1000 miles, reported satisfactory results in regard to acceleration, speed, starting qualities, and consumption per mile.

EDITORIAL COMMENT

In 1923, according to the Chamber of Commerce of the United States, the average annual income for each person in the country was $640; at that time, taxes in this country averaged $65 per person, or about one-tenth of the per capita income.

In 1938, the average annual income per person had dropped to about $500, while taxes had gone up to $103 per capita, or to more than one-fifth of the income.

Few people realize the seriousness of this condition to industry and to the men and women whose livelihood depends upon industry. Due to legislation that has hampered industrial activity and made it impossible to reduce unemployment, the average annual income has been reduced; at the same time, taxes have constantly increased, due to Government spending. Instead of going ahead, as this nation can and should do, we are economically sliding backward. Of what value is all our mechanical progress, our inventions, and our scientific research, if industry is to be so hampered by taxation and restrictions that this progress cannot be utilized in creating new industries, more employment, and greater annual incomes for all capable of working?

It is Time to Give Industrial Enterprise a Chance

Have we been engaged in an experiment that has proved unsuccessful? If so, is it not time to stop experimenting and begin to apply common sense—the good old common sense that in years past made this country the industrial leader of the world, with higher wages and better living conditions than anywhere else? Industrial enterprise made this possible; it is time that industrial enterprise again be given a chance.

At the present moment, our patent system is being closely scrutinized. There is no question but that the existent patent system has defects; but it has also much to commend it. The counsel recently given to the Temporary National Economic Committee by Conway P. Coe, United States Commissioner of Patents, is well worth heeding.

"For nearly a century and a half, the patent system," said Commissioner Coe, "has been regarded not merely as a lawful institution, but also as a benefactor of the nation. I am confident your Committee appreciates the wholesome influence that our patent system has exerted on the economic and social life of the American people. I am quite certain that you wish to preserve all that is good, while correcting whatever is evil."

The measures advocated by Commissioner Coe include the creation of a single court of patent appeals; leaving the life of a patent seventeen years, as at present, but having it expire automatically twenty years after the filing of the patent application, for the purpose of correcting the abuse of patent applications left pending for a long period of time; termination of interference procedure by a single decision of the Examiner of Interferences; abolition of renewal applications; reduction from two years to one year of the period in which an inventor may make public use of his invention before applying for a patent; reduction from two years to one year of the period in which an applicant may copy a claim from an issued patent for the purpose of asserting the priority of his invention; and the granting of authority to the Commissioner of Patents to require an applicant to respond to a Patent Office action within less than the normal statutory period of six months.

The Proposed Revision of Our Present Patent Legislation

The Commissioner also emphasized that the patent system is a democratic institution. It is shown by statistics compiled by the Patent Office that individuals are granted more patents than either the small or the large corporations, each considered as a group. Of the 335,000 patents issued from 1931 to 1938, individuals were granted 43 per cent; small corporations, 35 per cent; and large corporations, which maintain the greatest research and experimental facilities, 17 per cent. Foreign corporations obtained 5 per cent of the patents.

The Patent System Has Encouraged Our Technical Progress

On this subject, Dexter S. Kimball, formerly Dean of Engineering at Cornell University, has said: "Invention is distinctly personal in character. All of the great inventions are closely connected with the work of some individual. The race always makes progress through the individual and not through the mass."

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Mechanism for Operating a Floating Jaw Vise

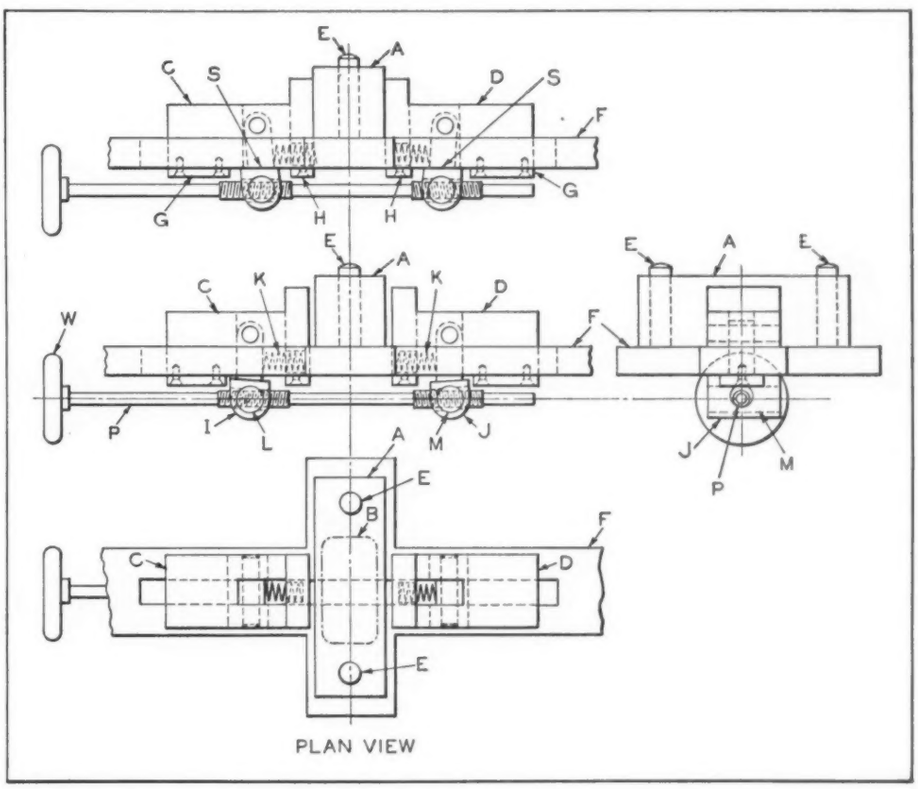
By L. KASPER

The accompanying illustration shows a vise used on a routing machine for holding a wood block *A* while a cavity is being routed out, as indicated by the dot-and-dash lines at *B*. The jaws *C* and *D* of this vise are operated by a mechanism that permits them to float to suit the work, locking firmly when the work is finally gripped. The work *A* is located on two pins *E* which enter two previously drilled holes. The jaws *C* and *D* prevent the wood from bulging under the pressure of the cut where it closely approaches the sides of the piece.

As the routing must be accurately positioned relative to the holes and as the width of the work varies considerably, it is necessary that the jaws *C* and *D* have a floating action. That is, the jaws must grip the work in the position in which it is located by the pins *E* before they are clamped to the fixture bed *F*. The jaws *C* and *D* are slidably mounted on base *F* to provide the required floating action. The base *F* is slotted to receive keys machined on the under side of the jaws. Retaining plates *G* and *H* are screwed to the under side of the keys to hold the slidable jaws in place. The blocks *I* and *J*, located in slots in the jaws, swivel on pins at their upper end, and are held at the back of the slots by means of springs *K*. Blocks *I* and *J* carry at their lower ends the swivel-pins *L* and *M*, which are threaded to fit the right- and left-hand threads on the rod *P*. Rod *P* is equipped with a handwheel *W* which is turned clockwise for clamping the work. The blocks *I* and *J* are T-shaped, being wider at the bottom, as shown in the end view to the right. The lower ends of blocks *I* and *J* are therefore wider than the slot in base *F*.

The two lower views show the vise in the open position, with work *A* located on pins *E*. In this position, the jaws and their blocks *I* and *J* are bound together by rod *P* and slide together as one unit on base *F*. When handwheel *W* is turned clockwise, the action of the right- and left-hand threads on rod *P* will throw swivel-blocks *I* and *J* toward each other. As pins *L* and *M* are prevented from swiveling by the resistance of springs *K*, jaws *C* and *D* are also thrown together.

When either jaw comes in contact with the work, its movement ceases, and the action of the screw is transmitted to the other jaw until they are both in contact with the work. Further turning of the handwheel causes blocks *I* and *J* to swivel on their upper pins, compressing the springs, so that at this point, work *A* is held by spring pressure. Continued turning of handwheel *W* causes blocks *I* and *J*



Mechanism that Causes Floating Jaws C and D to Grip Work A and then Grip Base F through the Clamping Action of Blocks I and J

to swivel still further until the enlarged or T-sections at their lower ends come in contact with the under side of base *F*, as indicated at *S* in the upper view, thus locking jaws *C* and *D* firmly in position.

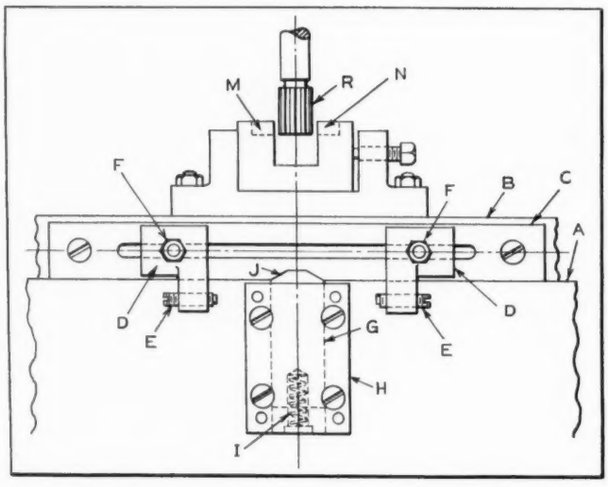
Work-Locating Mechanism for Milling Machine

By M. JACKER

On page 627 of May MACHINERY is shown a work-locating mechanism that was applied to a milling machine. The illustration in the present article shows another mechanism which the writer believes will accomplish the same purpose more efficiently.

This mechanism is very accurate, can be operated rapidly, and has a wider range of adjustment. Machine tables *B* that do not have bolt slots in the front face can be fitted with a slotted plate *C* to which stops *D* are clamped by bolts *F*. Plate *C* is held in place on the table by two machine screws. It will be noted that a shallow double-angle or beveled slot *J* is machined in the center of plate *C*. This slot is engaged by the point of latch *G* through pressure exerted by spring *I*. This arrangement stops or locates the table in the correct position for loading and unloading the work without interference of the cutter *R* with the sides of the slot in which the cavities are to be milled.

After the work is clamped in the fixture, cavities *M* and *N* are machined by the end milling cutter *R*. The pressure exerted by spring *I* is light enough to enable the machine or hand feed to disengage latch *J*. The machine feed can be used to within 1/32 inch of the final stops, after which the table is fed by hand until the points of set-screws *E* come in contact with latch casing *H* on the base *A*.



Milling Machine Equipped with Mechanism for Locating Table in Correct Position for Loading

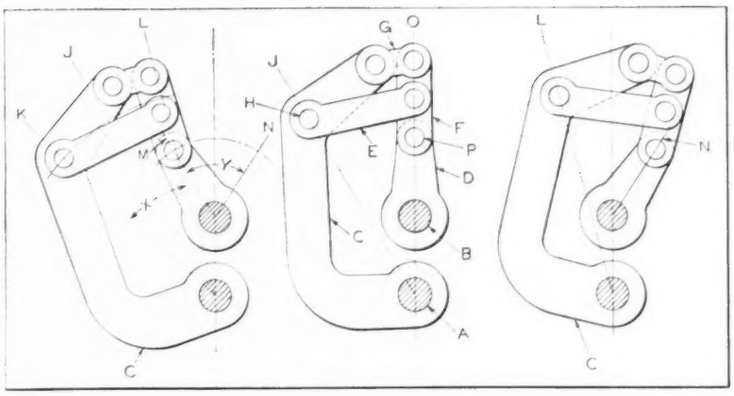


Fig. 1. Mechanism for Transmitting Oscillating Movement from Shaft A to Shaft B, the Latter Shaft being Oscillated through a Larger Angle than Shaft A

Crank and Link Mechanisms for Increasing Angular Movement of Shaft

By PAUL GRODZINSKI

In Fig. 1 is shown a simple mechanism designed to transmit an oscillating movement from shaft *A* to shaft *B*. The mechanism is required to give the driven shaft a larger angular movement than that of the driving shaft. A mechanism of this type for multiplying the angular movement of a lever was developed by H. Lindars. It consists simply of the driving lever or crank *C*, the driven crank *D*, links *E*, *F*, and *G*, together with the five pins that connect the cranks and links. The cranks *C* and *D* are securely fastened to their respective shafts *A* and *B* and oscillate with them.

The view at the left shows the mechanism with the driving shaft *A* and its lever *C* rotated to their extreme left-hand or counter-clockwise positions, while the view at the right shows the mechanism with the driving shaft and its lever rotated to their extreme right-hand or clockwise positions. The center view shows the crank *D* and driven shaft *B* in the vertical position, with pin *P* on the vertical center line *O* and pin *H* of the driving crank *C* located on the radial line *J*, which is also indicated as *J* in the view to the left.

When shaft *A* rotates to the left so that pin *H* is in its extreme left-hand position on radial line *K*, crank *D* will also have been rotated to the left so that pin *P* is located on the radial line *M*. Similarly, when shaft *A* rotates to the right so that pin *H* is in its extreme right-hand position on line *L*, as indicated in the view to the right, crank *D* will have been rotated to the right so that pin *P* is located on radial line *N*. Thus, an oscillating movement of driving shaft *A* and its crank *C* through angle *X* serves to oscillate driven shaft *B* and its crank *D* through angle *Y*, which, as shown in the illustration, is larger than angle *X*.

It should be noted that, while crank *C* makes an angular movement to the left of the central position shown in the center view equal to its angular movement to the right, the angular movement of

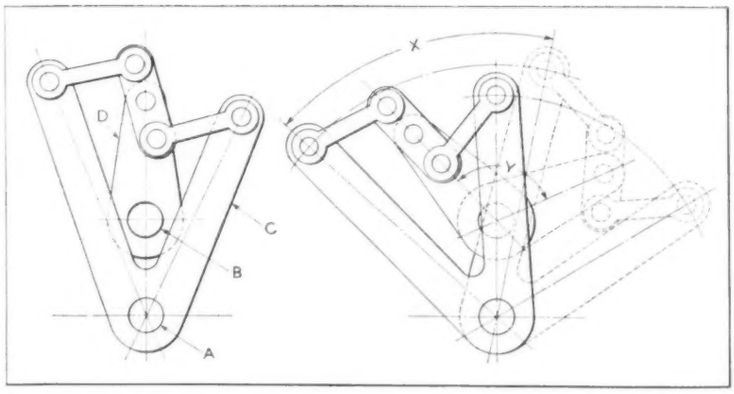


Fig. 2. Mechanism Designed to Transmit an Oscillating Motion from Shaft A to Shaft B with an Increase in the Angular Motion Imparted to Shaft B

crank *D* to the right from the central position is slightly greater than its angular movement to the left.

In the view to the left, Fig. 2, is shown another mechanism that is also designed to transmit an oscillating motion from one shaft to another with an increase in the angular movement imparted to the driven shaft. In this mechanism, which is patented in England under patent No. 465052, the oscillation of shaft *A*, and member *C* keyed to it, through angle *X*, as indicated in the view to the right, causes driven shaft *B* and its crank *D* to be oscillated through angle *Y*. In the view to the right, the mechanism is shown in full lines with its driving and driven shafts in the positions they occupy when they have reached the end of their rotating or oscillating movement in the counterclockwise direction. The dotted lines show the mechanism with its members in their positions at the extreme end of the clockwise movement.

Tripping Mechanism Operated by Revolving Shaft

By J. B. BOOTH

The article entitled "Tripping Mechanism Operated by Revolving Shaft," described in April MACHINERY, page 561, has helped the writer design a similar type of tripping device. This mechanism has been simplified in order to save material and space. The improved design eliminates the large member *J* shown in the orginal illustration.

As shown in the accompanying illustration, the lever *H* is provided with an integral extension piece *C* which acts upon roller *R*, causing it to transmit motion to the tripping lever *A*. Pad *L* is attached to lever *H*, as shown, and is located so as to come in contact with roller *R* when lever *H* is brought to its lowest position. The lever *H* has an oscillating movement obtained by means of shaft *B*, disk *D*, etc., as was described in the previous article.

Preventing Overloading of Press Motor by Suitable Control

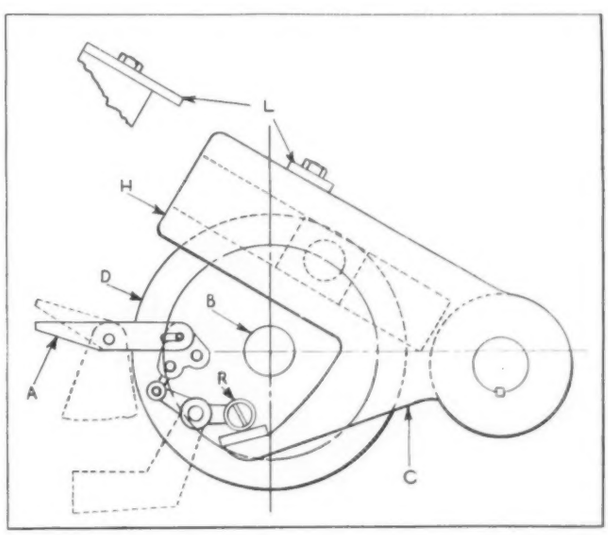
Our attention was recently called to the effect of proper motor control in a punching and stamping department. The device known as the "Capacitrol," made by the Wheelco Instruments Co., Chicago, Ill., is applied to an automatic press turning out aluminum stampings. The stampings have a tendency occasionally to pile up, and when they do, they cause serious trouble, such as the breaking of a die or the springing of a shaft on the press. The piling up of the pieces results in overloading the motor operating the press. The instrument referred to immediately indicates such overloading.

In this particular case, the instrument has a 25-ampere scale, and when the motor is drawing its normal load, the pointer stands at about 5 amperes. The control setting is normally at 6 amperes, slightly over the normal operating point. The press operates at the rate of 100 stampings per minute. The instrument acts instantly, because trouble is experienced as soon as three or four pieces pile up. The instrument actually stops the press before the third piece piles up on the second.

* * *

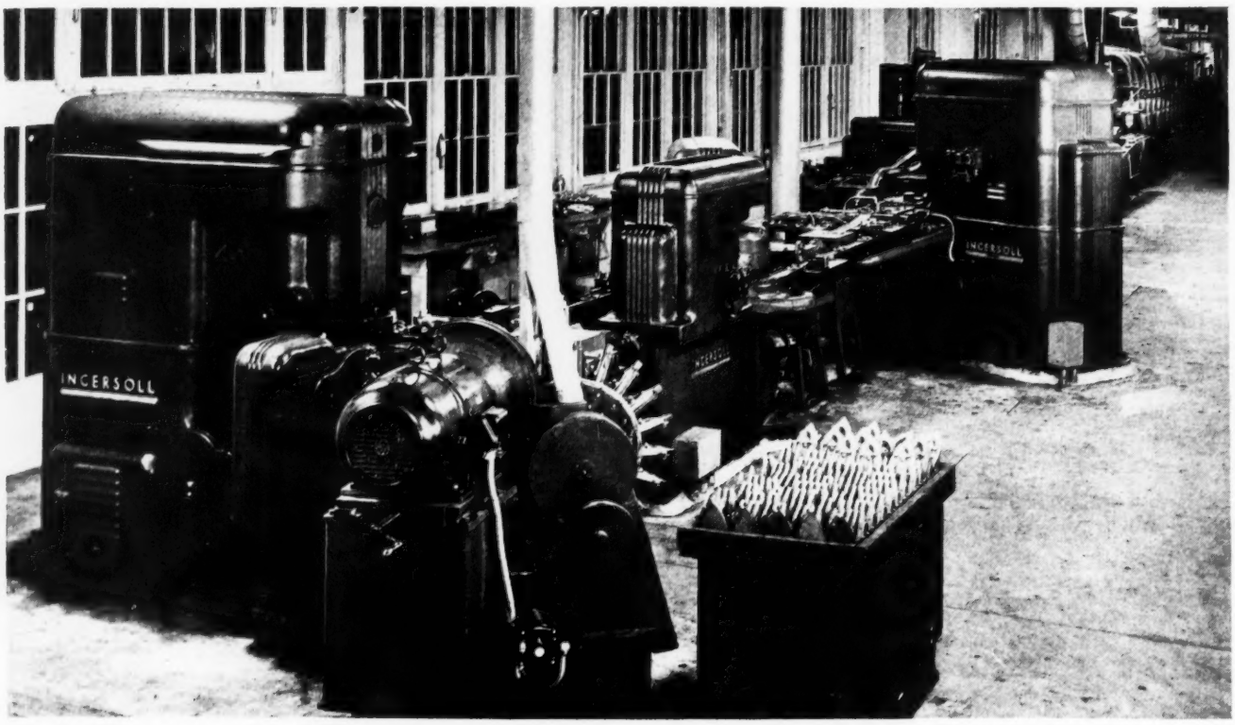
Marked Business Improvement During First Half of 1939

Orders booked by the Westinghouse Electric & Mfg. Co. during the first half of 1939 rose 36 per cent, as compared with the first six months of 1938, totaling over $104,500,000. The net income of the company for the first six months showed an increase of 41 per cent.



Tripping Mechanism Operated by Rotating Shaft B which Shifts Lever A with a Dwell between Movements

Machining and Polishing



Five Automatic Machines Connected by Conveyors are Employed in a Continuous Production Line for Machining and Polishing Flat-Iron Castings

WHEN the General Electric Co. transferred all its flat-iron manufacturing to the company's Ontario, Calif., Works in 1936, the resulting increase in production made possible the introduction of improved methods and the installation of new equipment. The machines here illustrated represent an important recent installation in the improvement project inaugurated at this plant. These machines have been arranged in a continuous production line for performing the machining operations indicated by the product progress diagram, Fig. 1.

The first five machines in the production line are Ingersoll fully automatic machines. This five-machine unit, consisting of the machines indicated diagrammatically at *A*, *B*, *C*, *D*, and *E*, Fig. 1, processes the castings which form the bottoms or ironing surfaces of the flat irons. The castings to be machined or processed come from the cleaning machine employed in the foundry in preparing work for nickel- and chromium-plating.

An automatic snag grinding machine, located at the left of the first automatic machine, shown in Fig. 2, removes the gates from the rough castings. The group of five automatic machines shown in Figs. 3 to 7, inclusive, completely machines and

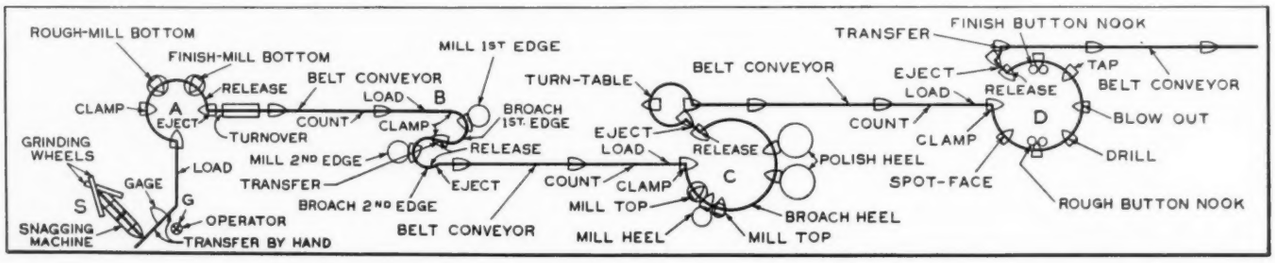


Fig. 1. Flat-iron Machining and Polishing Production Line, Consisting of Snagging Machine S,

Flat-Iron Castings

By W. H. TANGEMAN
Superintendent, Ontario, Calif., Works
of General Electric Co.

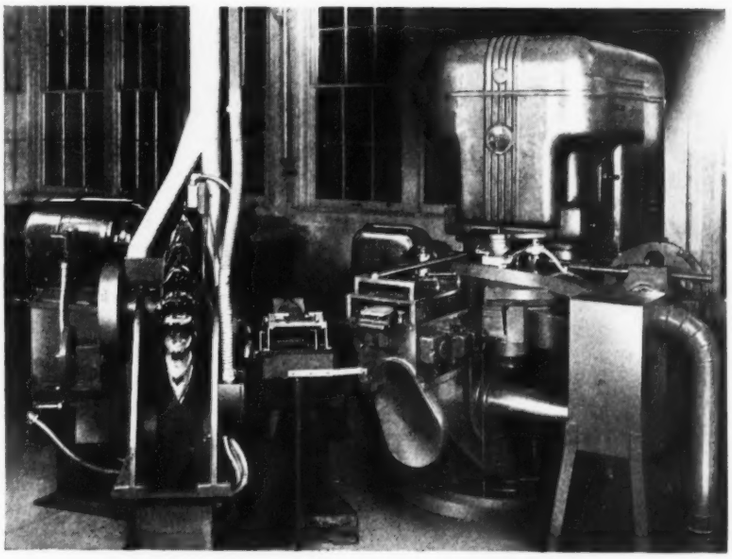


Fig. 2. Snagging Machine Indicated at S, Fig. 1, for Removing Gates from Rough Castings, Gage and Automatic Machine A for Rough- and Finish-milling Bottoms of Castings

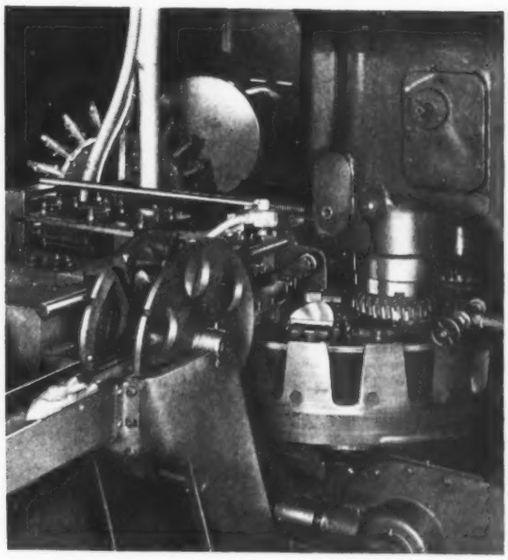


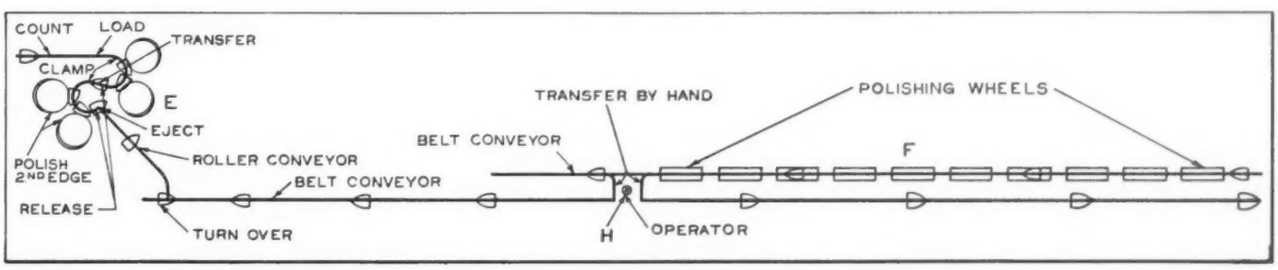
Fig. 3. View Showing Cutters and Casting-reversing Device of Machine Shown in Fig. 2

polishes the castings, with the exception of polishing the bottom surface. The latter operation is accomplished on the ten-wheel Excelsior special-purpose polishing machine indicated at *F*, Fig. 1, and also shown in Fig. 8.

The diagram, Fig. 1, indicates that the production line is entirely automatic in operation, with the exception that one operator, stationed at *G*, loads and unloads the snag grinding machine and places the castings in the automatic feed of the machine at *A*, and a second operator, stationed at *H*, loads and unloads the bottom surface polishing machine indicated at *F*, transferring the castings from a conveyor belt leading from the machine indicated at *E*. When the polishing operations on the casting are completed by the machine at *F*, the castings are automatically returned to the operator at *H*, who transfers them to a conveyor that carries them to the nickel-plating machine.

The flat-iron castings machined on this line are unannealed and weigh from 3 to 5 pounds in the rough. The bottom surface area is from 22 to 27 square inches, and the entire edge, which is milled with a step for locating the sheet-metal top, is approximately 5/8 inch thick. The castings are designed with radius edges and heel to facilitate automatic machining and polishing. The bottom and edges of the castings are finally chromium-plated to provide a fine finish, which requires a close-grained cast iron without surface defects. A general view of the entire production line is shown in the heading illustration.

As the diagram, Fig. 1, shows, the snagging machine is located at the left of the machine indicated at *A* (and seen in Figs. 2 and 3) which rough- and finish-mills the bottom surface of the castings. After the castings are snagged, the operator gages them and places them in the first automatic machine at the right, which performs its required operations, and then turns over the castings, and



Five Automatic Machines A, B, C, D, and E Connected by Conveyors, and a Ten-wheel Polishing Machine F

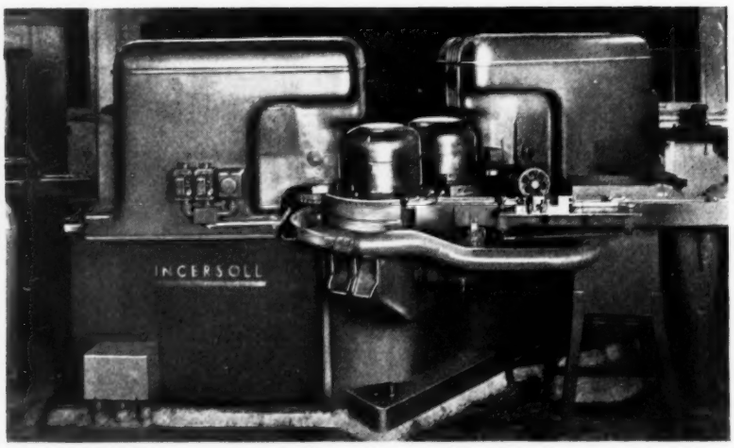


Fig. 4. Automatic Machine Indicated at B, Fig. 1, that Mills, Polishes, and Broaches Two Edges of Work

places them on a conveyor leading to the second automatic machine, shown in Fig. 4. Fig. 3 shows the milling cutters of the first machine and the device for turning over the castings at the unloading station. In this machine, the castings are located with their bottom surfaces up in fixtures carried on a rotating table. An interesting feature of this machine is that the castings are raised in the clamping station against a stop before clamping, so that a machining cut 3/64 inch deep is taken on each casting, assuring uniformly sound metal for the high finish required on the bottom surface.

Carboloy milling cutters are used for all milling operations. The first or rough-milling operation on the first machine is done with a 9-inch face milling cutter having a peripheral speed of 260 feet per minute, the casting feed being 46 inches per minute. The finish-milling operation is performed with a 9-inch face milling cutter having a peripheral speed of 310 feet per minute, the casting having a feed of 46 inches per minute. The operating speed of the first machine is adjusted to give a production rate of 470 castings per hour. This represents the operating speed of the line, the net output, with an allowance of 25 per cent for down time, being 350 castings per hour. Each successive machine is operated slightly faster than the preceding one to prevent an accumulation of castings on the conveyors between machines.

The second automatic machine, indicated at *B*, Fig. 1, and shown in Fig. 4, clamps the castings in fixtures on a rotating table, where one edge is milled and polished. The machine then transfers the castings to fixtures on a second rotating table, where the second edge is milled and polished. The castings are then ejected on a conveyor leading to the third automatic machine, indicated at *C*, Fig. 1, and shown in Fig. 5. The edges of the flat-iron casting are broached following milling in order to remove cutter marks, produce a slight bevel between the edge and the bottom surface, and accurately size the castings. Each of the two milling operations is done with a 9-inch edge milling cutter having a peripheral speed of 320 feet per minute, the work feed for these operations being 71 inches per minute.

As indicated by the diagram at *C*, Fig. 1, the third automatic machine, shown in Fig. 5, carries the castings, with their heels outward, clamped in fixtures on a rotating table for the following operations: Mill top, mill heel, mill top a second time, broach heel, rough-polish heel, and finish-polish heel. The castings are then ejected on a turntable, which places them on a conveyor leading to the fourth automatic machine, shown in Fig. 6 and indicated at *D*, Fig. 1. The first operation that mills the top surface of the casting is done with an 8-inch diameter face milling cutter having a per-

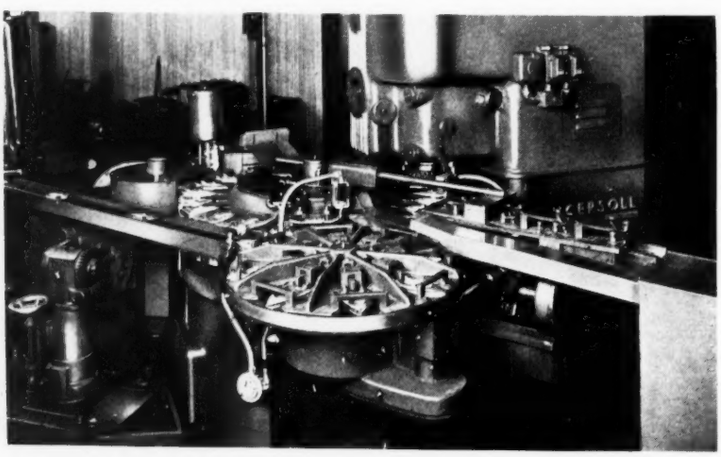


Fig. 5. Third Automatic Machine in Production Line, which Performs Operations Indicated at C, Fig. 1

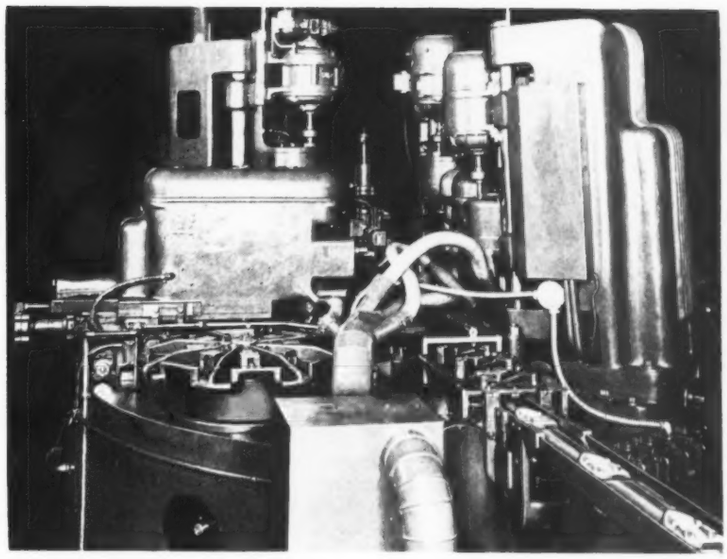


Fig. 6. Machine Indicated at D, Fig. 1, which Performs Spotfacing, Drilling, and Tapping Operations

ipheral speed of 250 feet per minute, the casting feed being 58 inches per minute.

All five automatic machines, with the exception of the one shown in Fig. 6 and indicated at *D*, Fig. 1, are equipped with constantly rotating tables carrying fixtures. The machine shown in Fig. 6 is equipped with a fixture-carrying table which rotates and indexes intermittently, the indexing period being approximately 7 1/2 seconds. The sequence of operations, as indicated on the diagram, is spot-face, rough-mill button nook, drill a maximum of nine holes, blow out and gage depth of holes, tap all holes, and finish-mill button nook.

To prevent the breakage of taps, the device that gages the depth of the holes is interconnected electrically, so that should a shallow hole be encountered, the entire line of machines will stop before the shallow hole reaches the tapping station. The milling, drilling, and tapping units are operated hydraulically. From this machine, the castings are ejected on a turntable which places them on a conveyor leading to the fifth automatic machine, shown in Fig. 7 and indicated at *E*, Fig. 1.

When the castings reach the machine shown in Fig. 7, they are first clamped in fixtures carried on a rotating table. In this machine, one edge of the casting first passes a rough-polishing wheel and then a finish-polishing wheel, after which the casting is transferred to a second rotating table where the other edge is similarly polished. From this machine the castings are ejected and turned over on a belt conveyor which carries them to a surface polishing machine equipped with ten wheels for polishing the bottom surfaces. This polishing machine, indicated at *F*, Fig. 1, is also shown in Fig. 8.

As shown in Fig. 8, the castings, carried in pockets, are fed successively under ten polishing wheels. They are returned to the loading position by first being carried on a conveyor along the floor and then returned beneath the polishing wheels. The first wheel is set up or charged with No. 60 emery. Each succeeding wheel is set up with a finer cutting material, the last or tenth wheel being a No. 240 oil-finish wheel.

The unit consisting of the five automatic machines is completely equipped with a chip and dust exhaust system which, with all electric wiring, is carried in a conduit below the floor. All machines are interconnected electrically and protected by

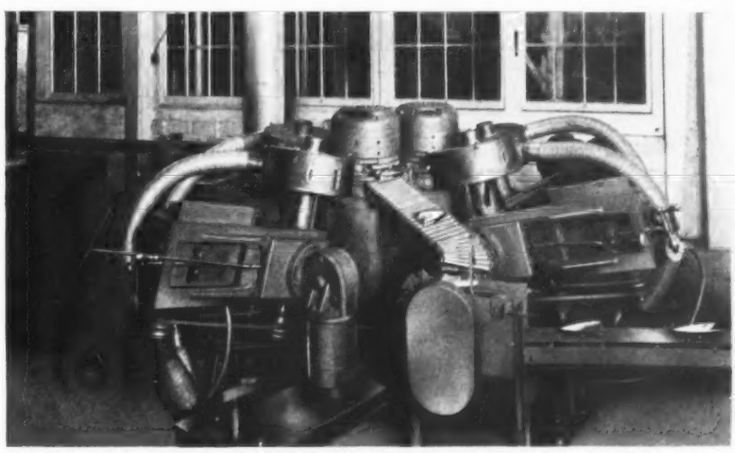


Fig. 7. Machine Indicated at E, Fig. 1, which is Located at End of Line of Five Automatic Machines

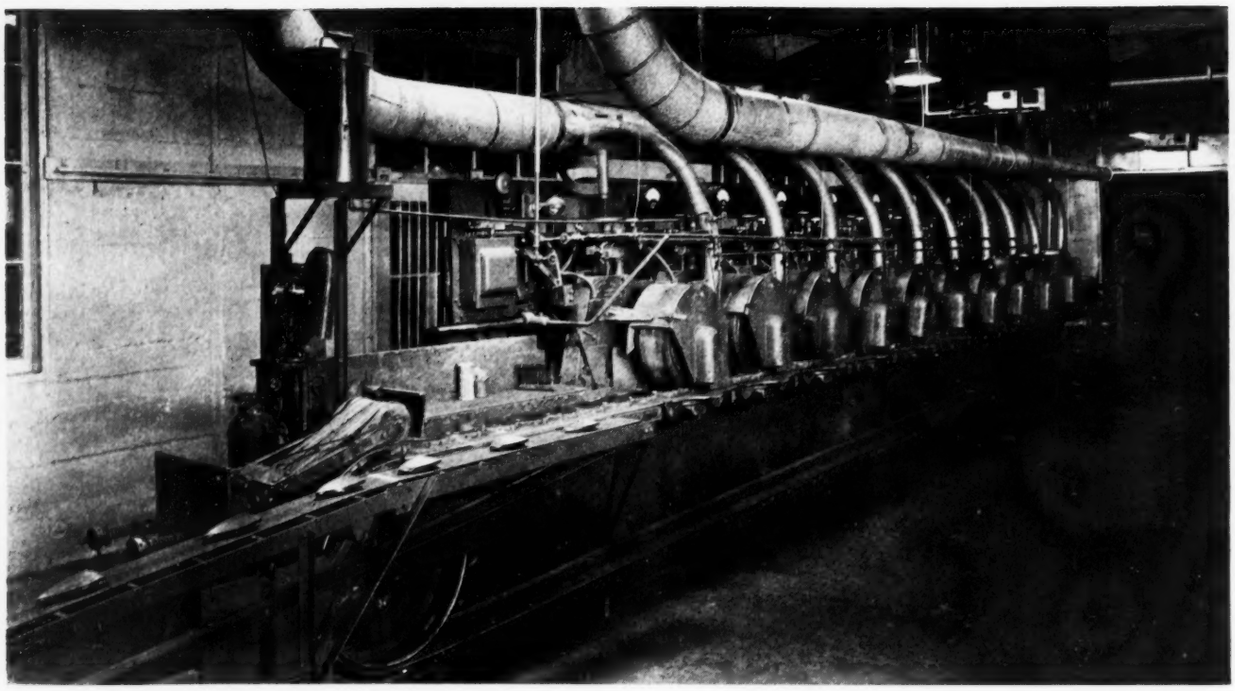


Fig. 8. Polishing Machine Equipped with Ten Wheels Charged with Abrasives of Varying Grain for Polishing Bottom Surfaces of Flat-irons

numerous limit switches. With this arrangement, the stopping of any machine as, for instance, through failure of a casting to be properly located in the fixture, will result in automatically stopping the feed to all machines. Signal lamps on each machine indicate which limit switch has operated or been responsible for stopping the machines. A control is provided, so that an operator can stop the feed of the entire line from any machine. Any machine or group of machines can likewise be operated independently of the remainder.

Each machine is equipped with a counter for each milling cutter. The counter indicates the number of castings that pass each individual cutter between grinds. By this method, the average number of castings per cutter grind can be determined, thus making it possible to predict quite accurately when a certain cutter will need grinding.

* * *

Calcium-Chloride Brine for Quenching Carbon Steel

Calcium-chloride brine solution is claimed to be superior to plain water for quenching high-carbon steel, since it removes the scale developed during the heating process and prevents the forming of soft spots. The Dow Chemical Co., Midland, Mich., produces "Dowflake" calcium chloride for this purpose and recommends that it be used in an 18 to 20 per cent solution, kept at a temperature of 80 degrees F. The hot steel, at a temperature of about 1550 degrees F., is quenched in the solution, after which the solution is washed off.

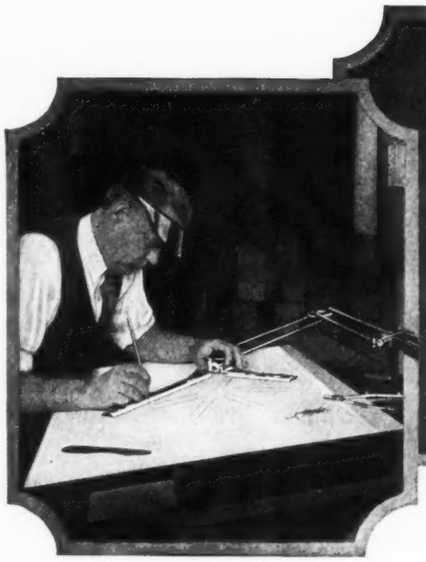
The Lubrication of Rubber Parts

With the more recent employment of rubber for bearings, bushings, and numerous other parts, especially in automobile construction, where motion is definitely associated with friction, lubrication has become an item to be considered. Ordinary lubricating oil cannot be employed, as it has a tendency to attack rubber. Even the fats contained in milk were found to attack rubber until a special type was developed for use in milking machines. Water can be employed, and in hydraulic work with rubber packing rings it becomes a natural lubricant. For the majority of applications, colloidal graphite suspended in water has been found suitable. This type of lubricant, however, has recently been displaced by a new compound which has proved even more successful. This consists of graphite in glycerine and water, the two liquids, both of value as lubricants, acting as carriers for the microscopic particles of graphite. The graphite preparation is the same as that used in Oildag and Aquadag. The minute particles of colloidal graphite penetrate between the rubber parts.

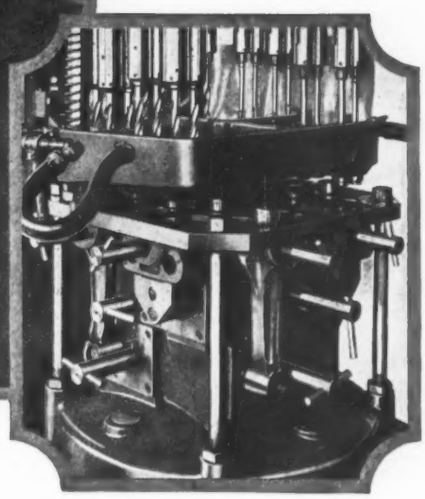
* * *

A Prolific Inventor

America's most prolific living inventor is said to be Carleton Ellis, of Montclair, N. J. At sixty-three, he has received patents on 750 inventions, compared to 1099 for the late Thomas Edison. He is particularly outstanding for his patents on quick-drying paint.



Design of Tools and Fixtures



Unusual Gages with Special Mountings and Dial Indicators

By F. H. MAYOH, Pawtucket, R. I.

Perhaps no gaging problems offer better opportunities for testing the skill of a designer than those in which dial indicators are used. The necessity for mounting the work so it can be quickly put in place and removed while locating from a desirable gaging surface makes such problems more interesting. The gaging devices shown in Figs. 1 and 2 provided satisfactory solutions for two problems of this kind.

A gage for testing the offset location of a rectangular extension relative to a central stem is shown in Fig. 1, where the work is indicated by dot-and-dash lines at *X*. Locating V-blocks for centralizing the round stem of the work are shown at *A* and *B*. The work is held down in the V-blocks by hand, being located endwise against the stop *D*. The base for supporting the entire gage is indicated at *C*.

The inspector holds the work lightly in the V-blocks while the lugs *Q* and *R* of an equalizer *E* press against both sides of the rectangular extension and thus square up the work about the central stem. The equalizer *E* has a clearance space between lugs *Q* and *R* and is held in place by a plate *F*. A spring *G* holds the equalizer against the work. The pin at *S* permits the operator to hold the equalizer down when necessary.

When the gaging end *P* of the dial indicator *H* is in contact with the work it gives a plus or minus reading on the dial, showing whether or not the flat is machined the correct distance from the round stem of the work. The indicator is mounted on an arm *J* which pivots about the stud *T*, so that the gage will clear the work while it is being inserted or removed. A hand-knob *N* is provided for convenience in lifting the indicator clear of the work.

An important feature of this gage is the post *M*, the hardened upper end of which provides a stop for the screw *L*. This enables the inspector always to swing the indicator into the same position, which is determined by using a master part for adjusting the dial gage to the zero point. With this arrangement, the dial gage will indicate any plus or minus variations from the standard zero gage setting.

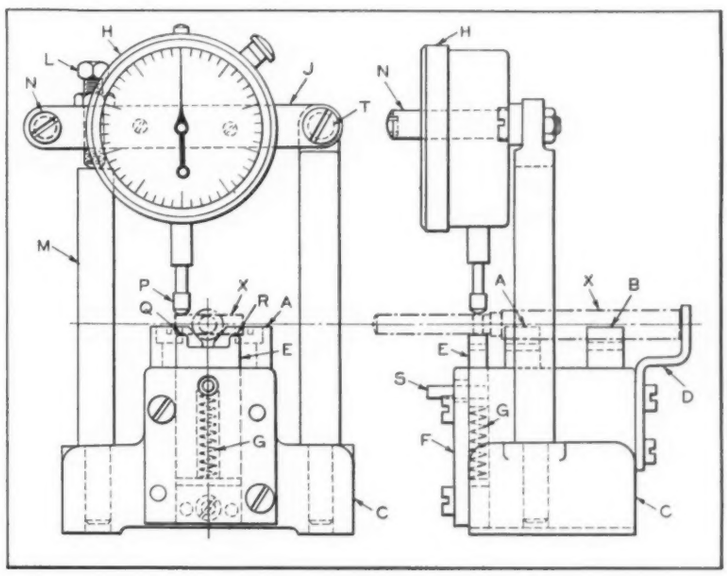


Fig. 1. Gage for Testing Offset of Rectangular Extension of Part X Relative to Round Stem

It will be necessary to give the gage shown in Fig. 2 more than a casual glance to appreciate what is actually being gaged. The work, shown by dot-and-

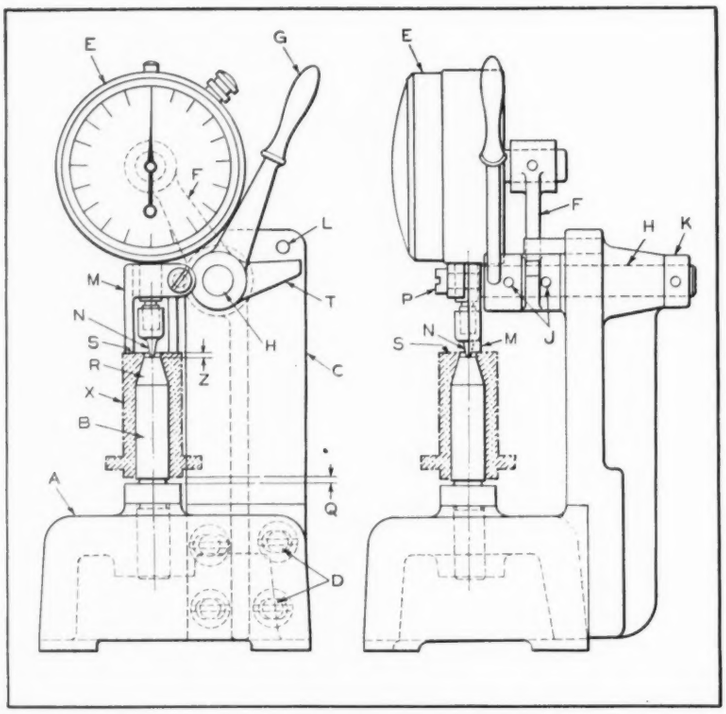


Fig. 2. Gage for Checking Position of End S of Work X with Reference to Taper R

dash lines at X, is mounted on the vertical arbor B, held to the base A of the gage, while the bracket C at the rear carries the indicator and gaging devices, being held in place by screws D and dowels. It will be noted that the work clears the shoulder of the arbor by an amount Q and therefore rests on the taper R.

The gaging problem is to register the position of the end of the work at S relative to the tapered hole at R. To do this, the upper end of the arbor is ground at a definite distance relative to the taper R, and the end of the dial indicator is provided with a special arbor contact point N. Over the outer sleeve of the dial indicator through which the plunger operates to move the indicator is placed a work contactor M, which is clamped in place by the binding screw P.

The dial indicator E is mounted, by means of a stem, to an arm F which, in turn, is attached to a short shaft H, on the forward end of which there is a lever G. Both the arm and lever are pinned to the shaft H, while a collar K keeps the entire unit in position in bracket C, taper pins J serving to hold the arm and lever in their correct radial positions. On the end of arm F is cast a projection T which acts as a stop in conjunction with pin L to prevent the dial indicator unit from dropping down when there is no work in the gage.

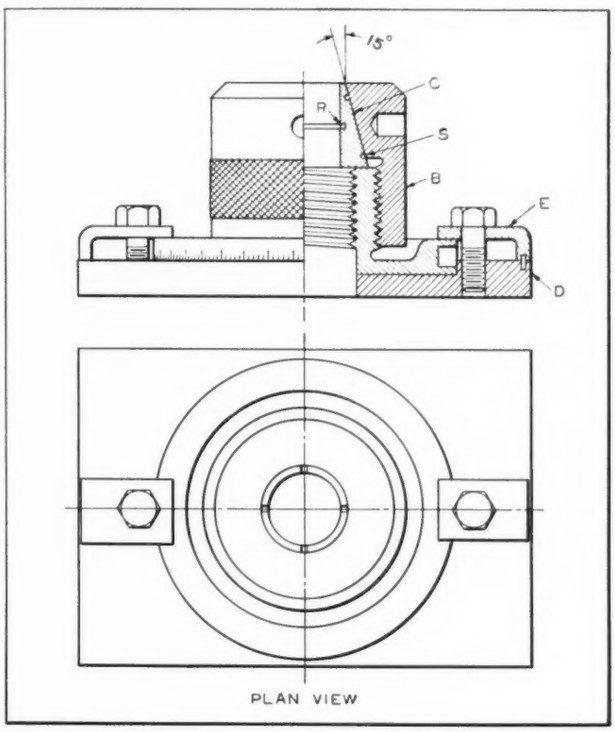
In using this gage, the inspector pulls lever G down, lifting the indicator with its work contactor M clear of the arbor. After the work has been put in place, lever G is raised, causing the work contactor to come down until it rests on the end of the work at S. At this time, the arbor contact point has moved the dial indicator needle so that it reads plus or minus within the number of thousandths allowable if the work is to pass inspection. The dimension Z represents the actual measurement taken. As the work rests on the taper at R, a true reading between the tapered hole and the end of the work is obtained.

Indexing Collet Chuck

By JOE R. COWLES, Columbus, Ind.

The indexing collet here illustrated consists mainly of four parts. The graduated internally and externally threaded part is made from a high-grade machinery steel and is a close fit on the lathe spindle nose. The knurled collar B is threaded to fit the external thread, the pitch of this thread being finer than that of the spindle thread. Part C is a collet split into four sections and grooved, as shown, for spring rings R and S. By using adapters for part C, various sizes and shapes of stock, as large as will pass through the spindle, can be held.

The flange of the threaded member is drilled so that a rod may be used in tightening or loosening it on the spindle nose. The edge of the flange is graduated into 360 degrees, making it a handy indexing device when used on a milling machine, surface grinder, or drilling machine. When the chuck



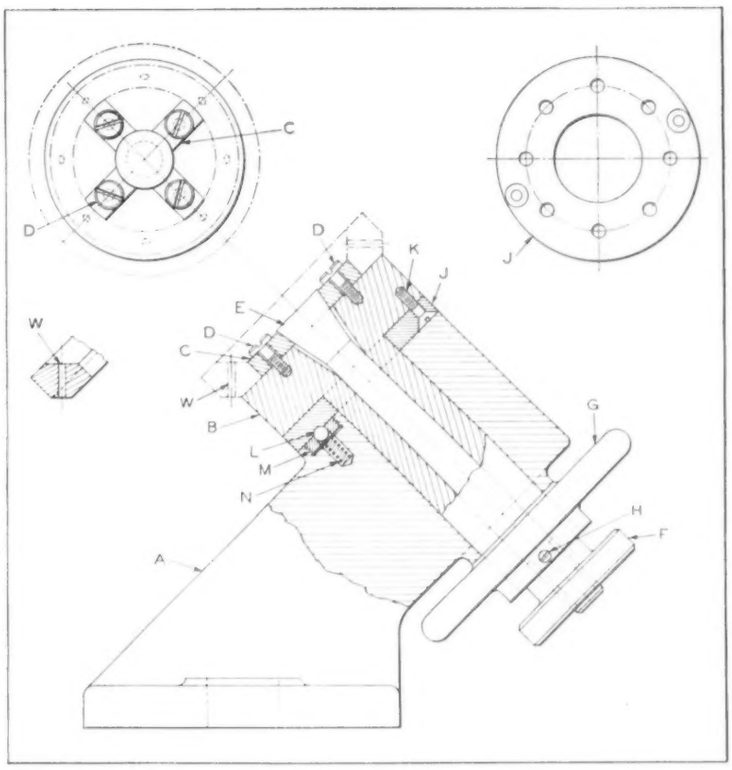
Indexing Type of Collet Chuck

is used in conjunction with the base *D*, the two clamps *E* are employed to prevent slippage. All wearing surfaces are casehardened and ground.

Indexing Fixture for Drilling Angular Holes

By JOSEPH WAITKUS, Wellsville, N. Y.

The fixture here illustrated is designed for drilling eight holes *W* in the ring shown by dot-and-dash lines. The drilled holes must be equally spaced on a circle in the inner face of the ring, and they must also be drilled at an angle of 45 degrees with the axis of the ring. The angular positions of the holes made it necessary to have the work-holding member located at an angle of 45 degrees with the fixture base. It was also necessary to provide means for spacing the holes around the ring without having to lay them out separately on each ring.



Fixture Designed for Drilling Eight Equally Spaced Holes W in Ring Shown by Dot-and-dash Lines

The fixture is provided with a base *A* which can be fastened to the table of the drill press. A trunnion *B* is fitted into a bore in the base. The chuck for clamping the ring is fitted to the trunnion, and consists of four sliding members *C* provided with slots into which the retaining screws *D* are fitted. One end of the sliding members is shaped to fit the inner face of the ring, while the opposite end is machined to fit the tapered head on the clamping screw. The screw *E* extends through the trunnion, and is provided with the tightening nut *F*. A handwheel *G*, fastened to trunnion *B* by setscrew *H*, provides means for rotating the trunnion with the chuck, as desired. It also serves as a means for holding the chuck steady while the clamping nut *F* is turned to actuate the sliding members *C* of the chuck.

The indexing templet *J* for spacing the holes is fastened to the trunnion by screws *K*. Templet *J* (shown separately in the detailed view in the upper right-hand corner) is provided with small indentations into which the indexing ball *L* fits. The ball *L* is fitted into a hole in the base *A*, and is kept in place by the nut *M*, which is machined to permit only a small part of the ball to project beyond the machined face of the base. A spring *N* serves to force the ball into the indentations in the templet and thus hold it in place in each position to which it is indexed.

The ring to be drilled is clamped in the chuck by tightening nut *F*. After each hole is drilled, the work is indexed into position for drilling the next hole by turning handwheel *G*. The indexing movement of handwheel *G* causes ball *L* to be depressed until the next indentation in templet *J* is located over the ball. The indentations are of sufficient depth to hold the ring securely during the drilling operation. Any spacing can be obtained with this fixture by simply providing a templet *J* having indentations machined to suit the requirements. Thus, the indentations need not be uniformly spaced, but can be arranged in groups or with irregular spacing, according to the work being handled.

Quick-Loading Chucks or Arbors

By M. JACKER, Oakland, Calif.

On page 503 of March MACHINERY is shown a quick-loading arbor for holding thin-walled rings that are to be finished on both sides. If the chucking end of the arbor were made 0.001 inch smaller than the minimum bore of the rings and if the rings were all within their specified size, their wall thickness would vary 0.001 inch. Adding to this the amount of bulge or deformation caused by the gripping roller, the total error in wall thickness would probably be at least 0.002 inch.

The writer believes that the quick-loading chuck shown in Fig. 1 will hold the rings firmly and also retain their true circular shape. The body of the chuck may be of cast iron and is machined on both inner and outer surfaces at *A*. The diameter at *C* is turned 0.001 inch smaller than the minimum bore of the rings. There is a small taper at *D*.

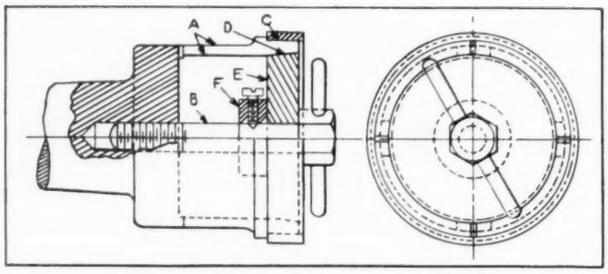


Fig. 1. Chuck for Holding Thin-walled Rings

Four equally spaced slots are cut in the chuck. Disk *E* is securely held in position by collar *F*. The chuck jaws are adjusted by turning the handle of screw *B*.

By J. B. BOOTH, Bradford, England

A quick-loading arbor that permits the turning of the outside and the end faces of the thin-walled ring *A* at one setting is shown in Fig. 2. The central portion of the arbor body is turned 0.0005 to 0.001 inch smaller than the minimum bore of the ring. Slot *B* is made 0.500 inch deep, with limits of + 0.002 inch and — 0.000 inch. The width of slot *B* accommodates roller *C*, which is 0.498 inch in diameter, with limits of ± 0.001 inch. Roller *C* has a 1/4-inch hole through it for pin *D*, which is 1/8 inch in diameter.

Both ends of the arbor body are threaded externally to receive two collars *E* and *F*, which have threaded portions near their outer ends. This permits their inner ends to be a sliding fit on the arbor, thus assuring accurate alignment. Collar *E* is first screwed on the arbor body. Ring *A* is then placed in position, bearing against the collar as shown. Next outer collar *F* is screwed on the body. A slight twist of the arbor in a clockwise direction serves to hold the work.

Ring *A* is first turned to the required diameter, after which collar *F* is removed to enable the operator to face the right-hand side of the ring. When this operation has been completed, collar *F* is replaced and collar *E* is screwed back so as to leave space for facing the left-hand side of the ring.

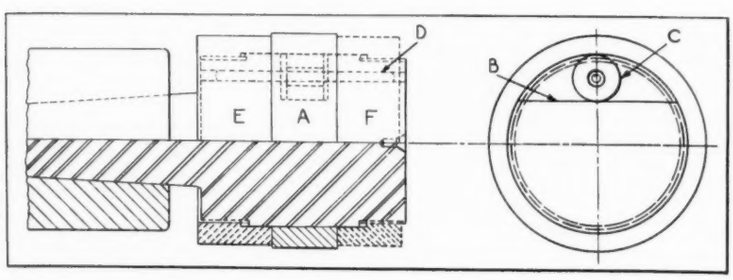


Fig. 2. Quick-loading Arbor that Permits Thin-walled Rings to be Finished all over in One Setting

By W. M. HALLIDAY, Peterborough, England

A quick-loading arbor for holding thin-walled tubular parts while turning the outside surface is shown in Fig. 3. One end of the arbor body *A* is turned to fit the tapered bore in the lathe spindle nose *B*, the remainder of the body being turned and ground to serve as an arbor for work *C*. Two grooves *E* are milled in arbor *A* for rollers *D*. The rollers are held in position by two collars *F* and *G*, collar *F* being pinned to the arbor. The arbor is made of cast steel, hardened and ground, grooves *E* being polished.

In operation, the arbor is first set up on the spindle nose. The work is then placed on the arbor body and given a clockwise turn. This causes the rollers to ride up the grooves *E*, binding the work to the arbor. The pressure of the cutting tool serves to increase the binding action of the rollers and hold the work more securely. After machining, a counter-clockwise turn releases the work.

* * *

The United States exports of industrial machinery during June, the last month for which complete statistics are available, were valued at $22,573,000. The export shipments of power-driven metal-working machinery, including machine tools, declined from $8,000,000 for June last year, to $6,660,000 for the same month this year. This rate of exports, however, is still very high, since it is at an annual rate of approximately $75,000,000.

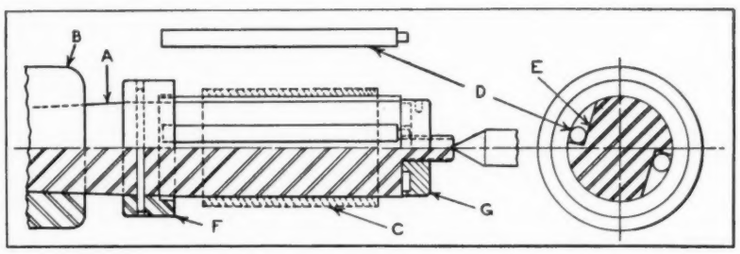


Fig. 3. Arbor with Two Friction Rollers D for Holding Tubular Work C

The exports of different classes of machine tools were as follows: Thread-cutting and automatic screw machines, $475,000; surface grinding machines, $194,000; internal grinding machines, $233,000; tool, cutter, and universal grinding machines, $323,500; other grinders and parts, $291,500; lathes, $1,148,000; vertical boring mills and chucking machines, $178,000; milling machines, $1,027,000; gear-cutting machines, $268,600; planers and shapers, $151,300; external cylindrical grinders, $214,500; and forging machinery, $394,000. Shipments of metal-working machinery other than power-driven were valued at $404,000, an increase of 26 per cent, as compared with last year.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Bending Brass Channels to Rectangular Shape

L. B. B.—Information is requested as to the most suitable design of tools for bending brass channel stock into a rectangular shape, as shown in Fig. 1, for use as a mirror frame. It is important that there be no distortion of the material. It is also desired to produce hexagonal-shaped frames from the channel material.

A.—A simple lathe can be used for the bending operation on the brass channel stock. If the headstock of the lathe has no back-gears, provision must be made for running the spindle at a much lower speed than that generally used on lathes of this type. The bottom slide of the compound rest should be released from its feed-screw and weighted, so that the rolling tool shown in Figs. 2 and 3 will be forced against the rectangular plate of the bending device. A lever can be provided for withdrawing the roller and a catch employed for holding it in the withdrawn position.

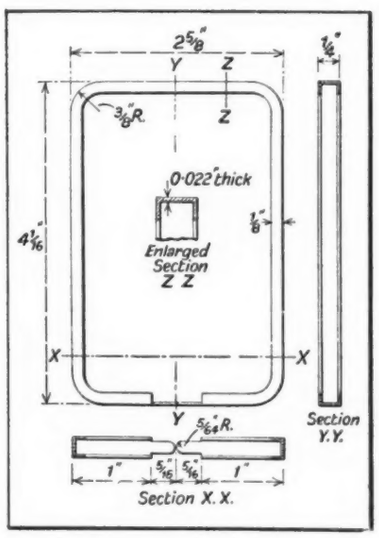


Fig. 1. Mirror Frame Formed from Brass Channel Stock

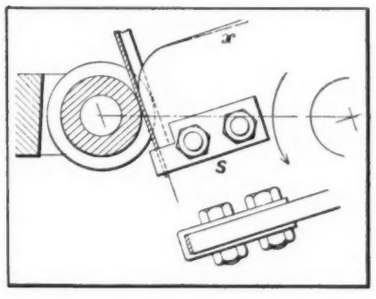


Fig. 2. Forming Plate and Roller with Channel in Position for Bending the Mirror Frame

The construction of the device is shown quite clearly in Figs. 2 and 3. It is important that the groove in the bending roller and the edges of the bending plate have smooth surfaces. All sharp corners must be removed from these two members. The channel to be formed is located as indicated in Fig. 2, with one of its narrowed ends in the slot between the stop-plate *S* and the bending plate. The spindle is then turned by hand to bring the channel into contact with the roller in the position shown. Next the lathe is started and the bending proceeds, care being taken to prevent the spindle from overrunning. A brake for stopping the spindle can be employed to advantage.

To prevent the sides of the rectangle from bulging outward, it may be necessary to make the edges of the plate slightly concave, as indicated at *x*. If a large number of frames is to be formed, it is advisable to harden both the forming plate and the roller. It may also be well to harden the stock.

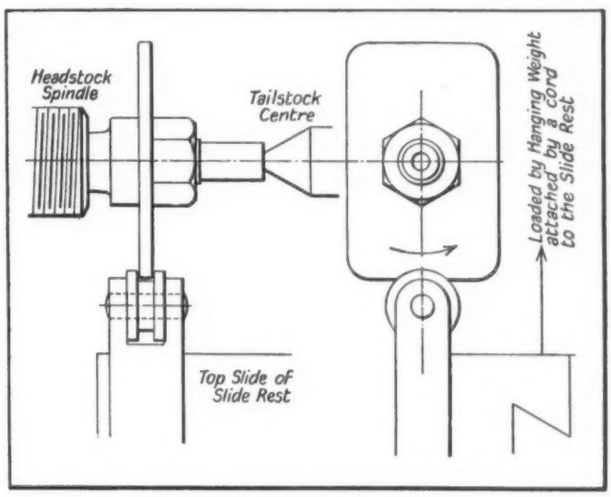

Headstock Spindle
Tailstock Centre
Loaded by Hanging Weight attached by a cord to the Slide Rest
Top Slide of Slide Rest

Fig. 3. Diagram of Roller and Forming Plate Set-up Used on Lathe to Produce Frame Shown in Fig. 1

A similar device would be suitable for forming the hexagonal-shaped frames, the plate in this case being hexagonal in shape. The objection may be raised that no provision has been made for removing the frames from the forming plate around which they have been bent. It is assumed, however, that if the mirrors can be inserted in the frames, the frames can be removed from a plate of the same size by springing the ends apart.

* * *

I view with alarm any effort on the part of State, church, engineering society, or labor union to restrict in any way the growth of science and invention and the economic improvements that flow therefrom.—*Dexter S. Kimball, formerly Dean of Engineering at Cornell University*

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Auxiliary Arbor Press Table

A small auxiliary table that can be fitted on any arbor press is shown in the accompanying illustration. This table is placed on the regular table of the press when small-sized work is to be handled. The use of two tables in this way is far more efficient than some makeshift provision for holding small work on the regular table.

Auxiliary Table for Handling Small Work on an Arbor Press

H. MOORE
Leeds, England

Wire Cutting and Forming Tools for the Shaper

The common shaper has many varied uses, including wire cutting and forming in the manner here illustrated. The piece *D*, Fig. 2, is completed by a cutting and a forming operation. A rapid cutter is obtained by using a slotting tool *A*, Fig. 1, set to operate against a hardened steel block *B*. The block is held in the shaper vise, the wire or rod being fed through a hole drilled in the block. The drilled hole is slightly larger than the stock to be cut off, and is countersunk on the feeding side to facilitate inserting and feeding the stock.

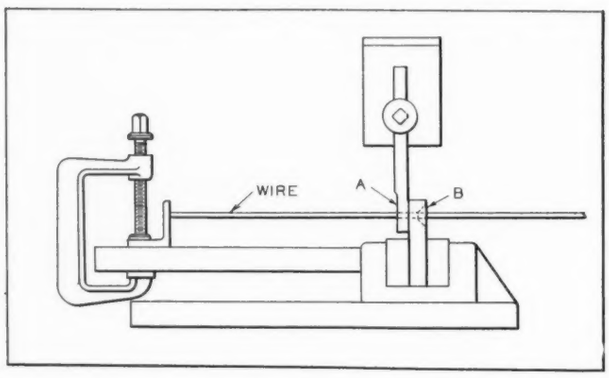


Fig. 1. Shaper Set-up for Cutting Wire to Uniform Lengths

A stop for gaging the length of the material cut may be clamped in the vise, as shown in Fig. 1. The shaper is run at thirty to forty strokes a minute, the stock being fed through the block on the return stroke of the ram. Wire and light rod up to 1/4 inch in diameter can be handled.

The forming dies are arranged as shown in Fig. 2. The machine must be operated more slowly for the forming operation to allow time for inserting and removing the pieces. Multiple forming and cutting operations can be easily arranged, thus providing an economical and efficient method of handling occasional wire forming jobs.

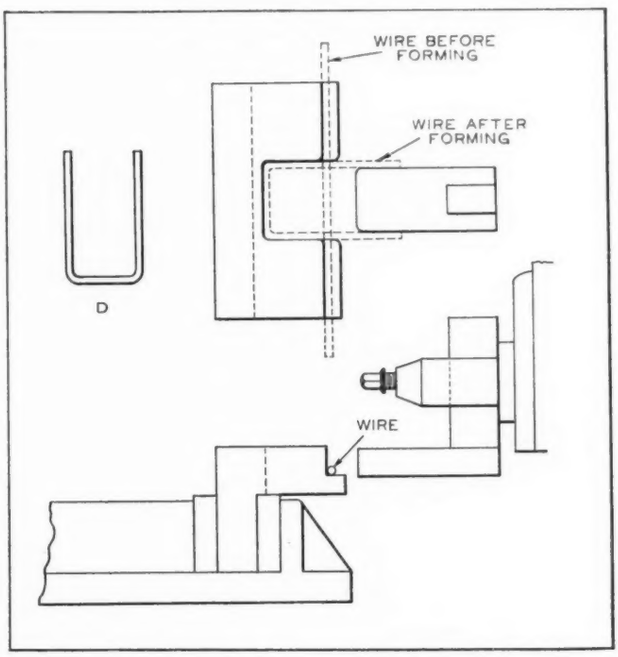


Fig. 2. Set-up Used in Shaper for Forming U-shaped Piece D

Niagara Falls, N. Y. ARTHUR OWEN

* * *

Transatlantic Air Mail Speeds Business

At 11 o'clock Saturday morning, June 10, the Selson Machine Tool Co., Ltd., London, England, cabled the Cincinnati Planer Co., asking for some blueprints to be sent immediately. The Selson company received the blueprints at 3 o'clock Tuesday, June 13, by Transatlantic Air Mail—a specific case indicating the possibilities of this new service.

The Heat-Treatment of Tool Steels

A Detailed Review of the Methods Used for Obtaining the Best Cutting Efficiency through the Heat-Treatment of Tool Steels—First of Two Articles

By ROBERT C. DEALE

THE heat-treatment of high-speed steel cutting tools may have a greater effect on their cutting efficiency than their precise chemical composition. If quenched from a temperature below its critical point, which is from 1800 to 2000 degrees F., a high-speed steel tool is little better than a carbon steel tool; but when quenched from 2400 degrees F., the high-speed steel tool may be capable of cutting as much as five times faster than if quenched at the lower temperature. It is necessary that all the factors in the hardening operation be controlled to secure the highest possible cutting efficiency.

A cutting test was carried out in a large machine shop under carefully controlled conditions to determine the heat-treatment that should be used in that shop. Two sets of six tools were cut from a single bar of tool steel and tested to destruction by turning two grades of cast iron. One set of tools was hardened according to the practice previously used in that shop. This heat-treatment was based on data furnished by the steel supplier, as interpreted by a hardener of reasonably good knowledge and experience.

The second set of tools was hardened by the same man in the same furnace, but according to data based on an interpretation of experimental work carried on at the United States Bureau of Standards. The second set of tools proved capable of cutting under identical conditions at speeds approximately 20 per cent higher than the tools hardened by the methods previously used, in spite of the fact that the second set of tools was inadvertently tempered at a temperature 100 degrees F. too high. This test was rather complete in that it involved twelve tools and at least six grinds per tool.

Variables in Heat-Treatment

The principal variables in the heat-treatment of high-speed steel are as follows:

1. Annealing
   - Temperature
   - Time
   - Method of cooling after annealing
2. Preheating
   - Temperature
   - Time
3. Hardening
   - Temperature
   - Atmosphere in furnace chamber during heating for hardening
   - Time at hardening temperature
4. Quenching
   - Medium
   - Temperature
5. Tempering
   - Temperature
   - Time at tempering temperature

All of these variables must be controlled within narrow limits if the best cutting qualities are to be secured. There is a considerable variation in the heat-treatments recommended by different steel manufacturers for the hardening of high-speed steels, even when there is little or no difference in the analyses of the steels in question. Taylor, in his work, met the same situation. In spite of the fact that each manufacturer recommended special heat-treatments for his brand of steel, Taylor found, in every case, that the standardized heat-treatment that he had developed gave better results than those recommended by the makers.

Recent research work appears to indicate that steels within a general class, such as 18-4-1 high-speed steels, may be heat-treated in an identical manner to develop their best cutting effectiveness. There is a relatively small range of variation—100 degrees F. or so—in hardening temperature for obtaining the maximum cutting qualities; this applies to the whole range of high-speed steels for which exact data are available. Tools of a given analysis from several reputable manufacturers, when given identical heat-treatment, are capable of practically the same cutting speeds under identical conditions.

Annealing Carbon Tool Steel

Tool steel should be annealed after each hot or cold working to reduce its hardness, remove strains set up by the working, and prevent the formation of a coarse crystalline structure. This is particularly necessary after a forging operation in which only a portion of the tool has been raised to a temperature above the critical point. Carbon steels containing approximately 0.90 to 1.30 per

cent carbon and small percentages, if any, of chromium, molybdenum, and tungsten should be annealed by heating to from 1375 to 1425 degrees F. until the tool is heated throughout, and then allowed to cool slowly, either in the furnace or by being buried in some insulating material, such as lime, infusorial earth, or ashes. When taken from the furnace, care should be taken to see that the tool is not placed on a wet floor, a piece of metal, or the like, which may cause local hardening.

Normalizing Carbon Tool Steel

While the annealing operation removes internal strains, it does not refine the grain of carbon tool steel. When this must be done, the following procedure will give satisfactory results: Heat the tool uniformly to the temperature specified in Table 1 and hold at this temperature until there is complete penetration of the heat, which causes refinement of the grain; then cool in still air. Table 2 gives the period of time required for heating the tool and the time it should be soaked at the normalizing temperature.

Table 1. Normalizing Temperature for Carbon Tool Steel

Carbon Content, Per Cent	Normalizing Temperature, Degrees F.
0.65 to 0.80	1475 to 1525
0.80 to 0.95	1475 to 1500
0.95 to 1.10	1500 to 1575
1.10 and over	1575 to 1650

Table 2. Normalizing Time for Carbon Tool Steel

Thickness of Largest Section, Inches	Weight, Pounds	Approximate Time of Heating, Hours	Soaking Time, Hours
Up to 1	Up to 100	¾	½
1 to 2	100 to 300	1¼	½
2 to 3	300 to 500	1¾	¾
3 to 4	500 to 1000	2¼	1
4 to 5	1000 to 1500	2¾	1
5 to 8	1500 to 2000	3½	1½

Preheating Carbon Tool Steel

To make sure that no undue strains are set up in a tool due to temperature differences in different sections, it is sometimes advisable to raise the tool to the hardening temperature very slowly, particularly when the tool is thick or of irregular shape. As it is impracticable in most cases to place the tool in a cold furnace and raise both tool and furnace slowly to the desired temperature, the usual practice is to bring the tool to the hardening temperature by one or two intermediate steps called "preheats."

The temperature required to harden a carbon steel tool is so low and the thermal conductivity of the steel is so good that it is unusual to preheat carbon steel tools unless they are of large or intricate shape. In such exceptional cases, a preheating temperature of about 900 degrees F. will give satisfactory results. The time in the preheating furnace should be just sufficient to bring the entire tool to the furnace temperature.

Hardening Carbon Tool Steel

Carbon tool steel should be hardened at temperatures that vary with the carbon content of the steel as indicated in Table 3.

Table 3. Hardening Temperatures for Carbon Steel Tools

Carbon Content, Per Cent	Hardening Temperature, Degrees F.
0.65 to 0.80	1450 to 1550
0.80 to 0.95	1410 to 1460
0.95 to 1.10	1390 to 1430
1.10 and over	1380 to 1420

Any type of heating equipment that will provide the required temperature may be used for heating carbon steel tools for hardening. A pot furnace containing a bath of molten salt or lead, heated by gas, electricity, or oil, is a very satisfactory type of equipment. Heating the tool in a bath not only insures a rapid and uniform rate of heat transfer, but protects the surface of the tool from the atmosphere, with the result that hardening is uniform, with practically no scaling or decarburization.

An oven furnace heated by electricity, having metallic resistors in the furnace chamber, is very satisfactory. There is a slight tendency toward scaling, which can be prevented, when desired, through the control of the furnace atmosphere.

The most generally used type of equipment is the gas-fired semi-muffle furnace, which is more flexible in operation than most other types because of its temperature range. A well designed furnace of this type, operating with a somewhat smoky flame, which produces a slightly oxidizing atmosphere, will leave the tools with very little scale. Such a furnace is frequently used when the shop requirements are so small that it is desirable to carry on all heat-treating in a single piece of equipment. A similar furnace using oil for fuel is also satisfactory, but is seldom used in small-sized installations.

A furnace having a full muffle, while entirely satisfactory for the purpose, is not generally used for hardening carbon steel because of the additional first cost of the equipment and the higher operating charges, which do not seem warranted if the furnace is only used for this purpose.

Quenching Carbon Tool Steel

In quenching, it is necessary to reduce the temperature of the tool below the critical point with sufficient rapidity to prevent changes in molecular structure that would reverse the hardening effect and leave the tool soft. A carbon steel tool is usually quenched in brine, consisting of a solution of sodium or calcium chloride in water, at about 70 degrees F. The tool may be removed from the brine and placed in oil while it still retains a considerable portion of its heat.

The high-manganese, non-deforming tool steels

which are frequently used for forming tools, the contours of which are not ground after hardening, should be quenched directly in oil.

Tempering Carbon Tool Steel

The hardening of steel tends to set up internal stresses which cause brittleness and a tendency for the cutting edge to chip or for the tool to break under the cut. These stresses can be relieved by tempering at the temperatures given in Table 4.

Table 4. Tempering Temperatures for Carbon Tool Steel

Results Desired	Tempering Medium	Tempering Temperature, Degrees F.
Relieving strains	Oil	300 to 375
Relieving strains and reducing brittleness	Oil	375 to 500
Relieving strains and toughening	Oil	500 to 650

The tempering of tool steel can be carried on in any convenient type of equipment. The temperatures used are relatively low, so that there is little difficulty from scaling or decarburization. At least 30 minutes, and preferably from 60 to 120 minutes, is required at the tempering heat for reasonably complete tempering. The type of furnace used should be one that demands the minimum of attention and permits a large number of tools to be handled at the same time. For tempering carbon steel tools, the oil bath is frequently used. It will accommodate large quantities of tools, provide uniformity of temperature, and protect the tool surfaces against the atmosphere.

The strength of an untempered carbon steel tool, as measured by a torsion impact test, is approximately one-fourth of its strength when so tempered as to develop maximum strength. Since the latter point is close to the point of maximum cutting efficiency, most carbon steel tools are tempered to secure the greatest strength. The relation between strength and tempering temperature is given in Table 5.

Table 5. Relation of Tempering Temperature to Strength of 1.06 Per Cent Carbon Tool Steel Quenched in Brine from 1450 Degrees F.

Tempering Temperature, Degrees F.	Relative Torsion Impact Strength	Rockwell Hardness C Scale
0	0.21	67
100	0.27	67
200	0.37	67
300	0.55	67
350	1.00	65
400	0.90	63
500	0.41	59

Heat-Treatment of Special Tool Steels

So-called "fast finishing" steel, in general, is hardened much the same as regular carbon tool steel. The temperatures used should be as follows:

Anneal at from 1450 to 1525 degrees F. and cool in the furnace.

Harden at from 1475 to 1525 degrees F. and quench in water.

Temper at from 300 to 500 degrees F.

The hardening of non-shrinking, non-deforming, oil-hardening tool steel follows, in general, the methods outlined for carbon tool steel, using the following temperatures:

Anneal at 1475 degrees F. for steel containing approximately 0.50 per cent tungsten, and at 1400 degrees F. for steel containing no chromium or tungsten.

Heat slowly and uniformly for hardening to 1200 degrees F., then more rapidly but uniformly to from 1450 to 1500 degrees F. The heating should be done very gradually and uniformly, preferably in a muffle furnace with the steel not in contact with the flame or combustion gases. The absorption and diffusion of heat appear to be much slower than in ordinary carbon or alloy steels; hence, these steels should be heated more slowly and quenched less drastically.

Quench in light oil, but do not cool the tool below 212 degrees F.; next temper by reheating immediately in oil or other medium, heating to a temperature of from 325 to 400 degrees F., and holding the tool at this temperature for about 30 minutes; then cool in still air.

In the concluding article on this subject, the heat-treatment of high-speed steel is covered.

* * *

Business Better in 1939

The American Gear Manufacturers' Association, with headquarters at 602 Shields Bldg., Wilkinsburg, Pa., representing the gear industry of the United States, reports that the sales of gears for the month of July were 34 per cent ahead of July, 1938. Furthermore, the seven months ending with July, this year, show a gain of 21 per cent over the same period last year. The gear industry is probably as accurate an index of the general conditions in the mechanical industries as is available, since gears enter into most machines and devices, and are ordered only as they are actually required.

* * *

A Suggestion System that Produces Results

During the first six months of this year, the General Electric Co., Schenectady, N. Y., paid $32,570 to employes who submitted ideas under the company's suggestion system. This was an increase of 4 per cent over the corresponding period in 1938. In all, there were 15,407 new ideas submitted, of which 5304 were accepted. The General Electric Co.'s suggestion system has been in operation for a great many years, and has proved a practical means for stimulating ideas.

Value of Apprenticeships Fully Recognized in Europe

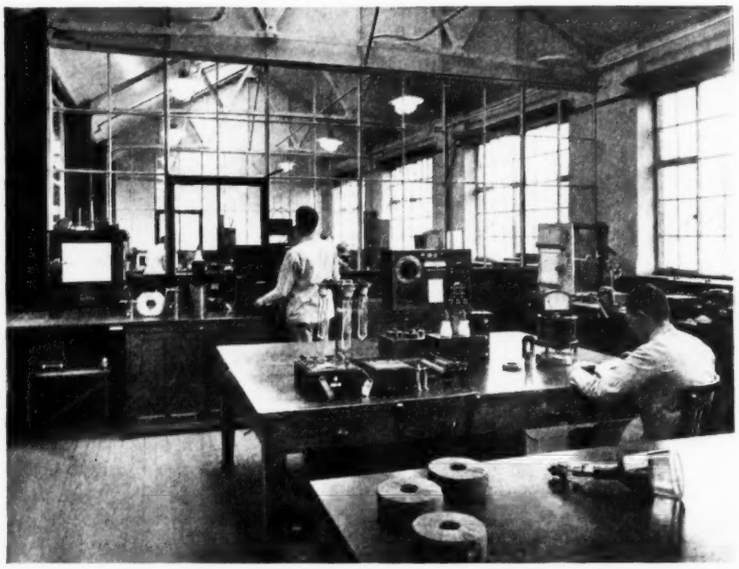


Fig. 1. Apprentices in the Works of the British Thomson-Houston Co., Ltd., Who have Advanced to a Point where They are Performing Work in the Research Laboratory

IN Europe, generally, apprenticeships have been a traditional institution for centuries. As modern methods of manufacture have taken the place of the old handicrafts, the importance of the proper training of apprentices to take the place of the older mechanics has not been lost sight of. Throughout the industrial countries of Europe, one finds highly developed apprenticeship systems in all the leading plants, large and small.

One of the outstanding systems of training courses in England has been developed by the British Thomson-Houston Co., Ltd., Rugby. These training courses include a student course for university and college graduates, an engineering course for young men that have an education corresponding to what we would call trade school graduation, a drawing office course for young men having what corresponds to our high-school education, and trade apprentice courses for boys with regular grammar school education. Ability is encouraged, and many of the boys who are taking these courses are transferred annually to a higher grade course, when able to meet the requirements. Thus, for example, the apprentices often advance so that in their final year they work in the company's laboratories.

The company maintains a special apprentice training department in which all apprentices commence their practical training before entering the various production departments of the plant. The training department is furnished with all types of standard machine tools, electric arc and acetylene welding equipment, and tools and equipment to provide the apprentices with a thorough practical training in bench work. In this department, under the guidance of instructors who are highly skilled craftsmen, the apprentices obtain a general, but thorough, knowledge of machining, assembling, sheet-metal working, and welding. Here they also gradually become acquainted with the methods of a large engineering plant.

Fig. 2. Manual Skill is Insisted upon in the Fritz Werner Apprentice Training School, where All Apprentices must be Capable of Doing Approved Scraping of Surfaces and Other Operations Requiring Skill of the Hands

Fig. 3. Apprentices in the Fritz Werner Plant Engaged in Assembling Vises. The Boys are First Instructed in a Special Apprentice Training School, and Later Perform Regular Production Work in the Various Departments of the Plant

The trade training courses cover a period of five years. The apprentice usually enters at the age of sixteen and completes his course when he is twenty-one. The apprentices are required to attend technical evening classes or to acquire theoretical knowledge of their work in some other approved manner. They must give evidence of their progress by passing, each year, the examinations required by the apprenticeship committee.

In Germany, apprentice training is also developed to a high degree in all plants of importance. The larger machine tool building plants, especially, have highly developed apprentice courses. In February MACHINERY, page 404, the apprentice training course at the Pittler Works in Leipzig-Wahren was briefly referred to. Similar well organized courses are found in a number of plants, the one at the works of Fritz Werner A. G., Berlin-Marienfelde being an outstanding example.

Here 350 boys are being trained in the various trades required in a machine tool building plant—

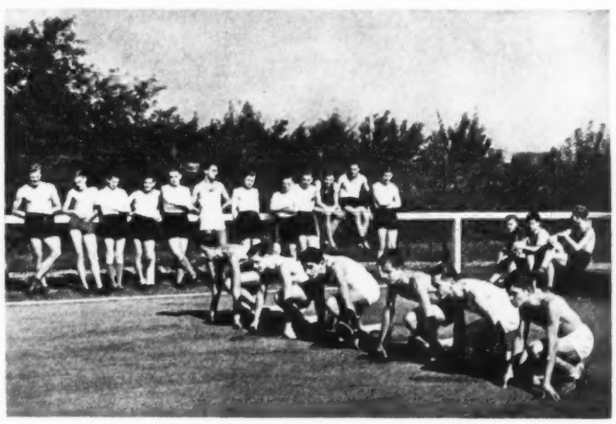


Fig. 4. A Group of Fritz Werner Apprentices on the Athletic Field. Athletics and Sports are Emphasized as Part of the Training

chiefly, of course, as machinists and toolmakers. The course is of four years' duration, and the training is arranged according to the usual European pattern—that is, the boys are first trained in a special apprentice department under capable instructors and are later transferred to the various departments in the shop. In this way, the apprentice is certain to receive a thorough fundamental training in all the ordinary shop processes before he is transferred to a production department where, to some extent at least, he must take his place in the regular production procedure.

In all the European apprentice training methods, athletics and sports play an important part, but, perhaps, nowhere more so than in Germany, where at the present time, athletics and physical training methods have been very highly developed.

There is no doubt that the attention being given to apprentice training throughout all the European industrial nations will have an important bearing upon the industrial position that these nations will occupy and maintain in the future.

Metal-Working Machinery Exports Continue to Rise

The United States exports of metal-working machinery during the first six months of 1939 reached the all-time high of approximately $55,700,000, as compared with $51,560,000 for the corresponding period of 1938, according to the Machinery Division of the Department of Commerce.

Japan was the chief buyer, the shipments for the first six months of 1939 amounting to $14,724,000. Exports to Manchuria also increased. Together, Japan and Manchuria took almost 30 per cent of the exports of metal-working machinery.

The exports to the United Kingdom rose from $8,135,000 for the first six months of 1938 to $12,268,000 in the first half of 1939. On the other hand, metal-working machinery exports to the Soviet Union fell from $16,080,000 in the first half of 1938 to $9,776,000 in the first six months of 1939. The reason for this dropping off in exports to the Soviet Union appears to be that Germany again is in a position to supply this market.

The French participation in American metal-working machinery exports during the first six months increased from $2,218,000 in 1938 to $7,893,000 this year. It is expected that shipments to France will increase for some time to come.

The four chief markets for American metal-working machinery—Japan, United Kingdom, Soviet Union, and France—accounted for 83 per cent of the total exports of metal-working machinery from the United States.

* * *

Reporting on a Company's Business to the Employes

Among the many industrial corporations that have of late prepared reports on their activities for their employes is the Clark Equipment Co., Battle Creek, Mich. This company has prepared an attractively printed report covering the activities of its various plants, explaining the purposes of the balance sheet and showing how the money received for the products of each employe is being used.

The report mentions that the sales receipts of the company for each "productive" employe amounted to $4544. Of this, $2482 went to pay the wages of labor and provide materials; $390 went to pay the wages and salaries of so-called "non-productive labor." For every employe, $148 went to pay taxes. Then, $1359 went to pay for tools, lubricants, supplies, repairs and maintenance, depreciation, fuel, power, heat, salaries of plant personnel and management, development expense, sales expense, and corporation expenses. This left $165, of which $110 was used to pay interest and returns on the capital invested in the enterprise—that is, payment for the use of buildings, machinery, and equipment employed by labor in producing the product; $55 was added to working capital.

A New Landis Hydraulic Plain Grinder

Fig. 1. Landis Hydraulic Grinder Developed for Rapid Production of Small Parts

THE Type 4H small plain hydraulic grinder shown in Fig. 1 has recently been added to the line of machines made by the Landis Tool Co., Waynesboro, Pa. This new grinder has been developed especially for the rapid production of work up to 1 1/2 inches in diameter. It is built in two lengths to handle work 12 and 18 inches between centers. Both machines have a swing of 4 inches.

In design this machine is a departure from the conventional external grinder in that various combinations of hydraulically controlled movements have been developed to reduce the floor-to-floor production time. Flexibility and ease of operation have been obtained by grouping the hydraulic and electric controls at the front of the machine within easy reach of the operator. A special feature developed by this company automatically compensates for variations in the viscosity of the hydraulic oil due to temperature changes, so that the speed of all movements, once set, remains constant. All mechanisms are completely covered, yet they are readily accessible through the use of hinged covers and doors.

The machine has been designed for either plunge cut or traverse grinding operations, being so arranged that the change in operation is easily made by a single selector valve. The rate of grinding feed is controlled by a knob at the center of the in-feed lever. When the selector valve is set for a traversing movement and the wheel base is brought forward, the headstock and coolant pump motors are started and the traverse reciprocated within the range set by the reversing dogs. Intermittent feed occurs at each reversal of the traversing movement.

The amount of feed is controlled by the same knob which controls the continuous feed in the plunge cut cycle. The position of the wheel is set by a hand feed mechanism built integrally with the wheel base casting. The handwheel is graduated to 0.001 inch and a vernier knob, located at the center of the handwheel, is graduated to 0.0001 inch.

The variable-speed headstock provides speeds ranging from 200 to 900 R.P.M., controlled by a knob on the front of the machine bed. The footstock can be furnished with either a hand-lever or a foot-operated pedal. The wheel-truing diamond bar is built into the footstock base and is adjusted by a graduated knob to any work diameter within the range of the machine.

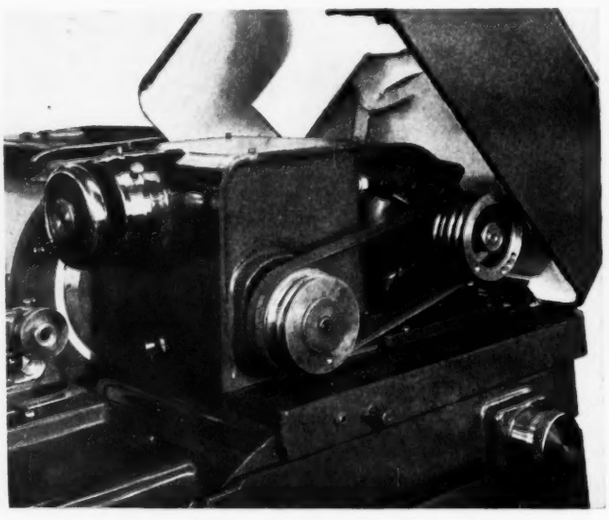


Fig. 2. Wheel Base of Grinder with Cover Raised to Show Wheel and Cone Pulley Drive

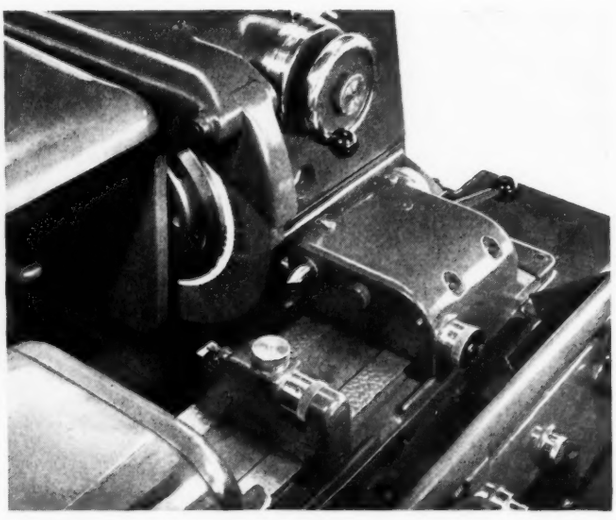


Fig. 3. Footstock with Adjustable Truing Diamond and Back-rest on Table of Landis Grinder

A single drive of two V-belts, from the wheel motor to the grinding wheel, is arranged with double-step cone pulleys so that the wheel speed can be increased as the wheel wears down without changing pulleys. The water service is built within the wheel fender. The baffled oil and water tanks are contained in the base of the machine, forming box sections which, together with the cross ribbed construction of the under side of the base, give the bed structure great rigidity.

* * *

"Electrex" Cleaner for Electroplating

According to information made available by the Magnus Chemical Co., Garwood, N. J., a new and better method for cleaning metal surfaces for electroplating and other finishes has been developed. This method makes use of a new type of cleaning agent known as "Electrex," which provides for more rapid and thorough cleaning; it is particularly suitable before bright plating. Electrex is used at high concentration and high current density with reverse current. The usual electro-cleaning equipment with steel tank and plate steel cathodes suffices. The work should be the anode, except with die-cast metal, zinc, and aluminum, in which case the work should be the cathode.

* * *

Standards for Pipe and Tubing

The American Standards Association has announced approval of a new standard for dimensions and materials of wrought-iron and wrought-steel pipe and tubing. This standard has been tested over a three-year period in actual use and has demonstrated its practical value.

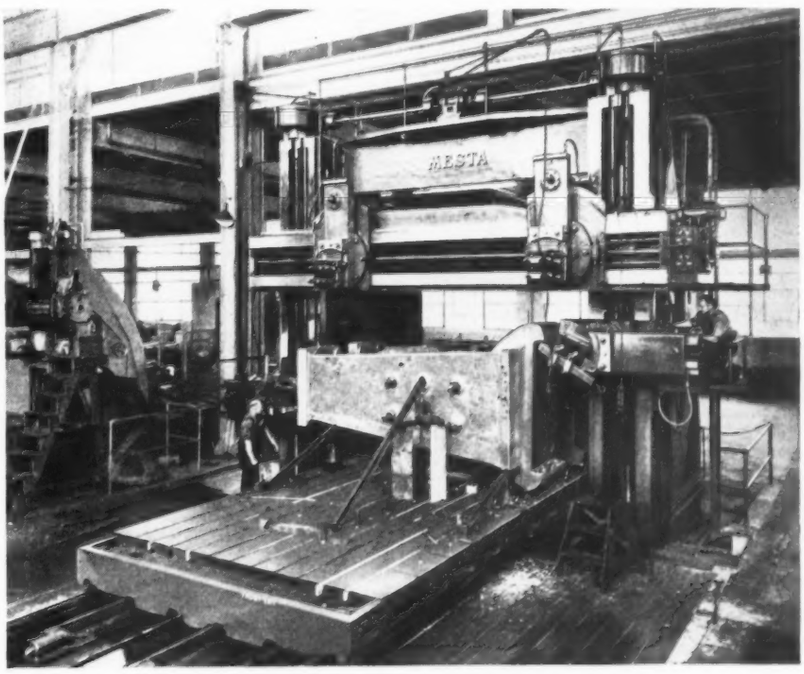
Until recently, commercial requirements for wrought-iron and wrought-steel pipe were fairly well met by the three schedules for pipe known as standard weight, extra strong, and double strong, that came into use in 1886. Within the last twenty years, however, steam pressures and temperatures have climbed above 250 pounds per square inch and 600 degrees F., which had been the maximum during the preceding decades. New industrial uses in the oil and gas fields also brought demand for new wall thicknesses and diameters. To meet these and other purposes for which such pipe and tubing are now used, the new standards have been adopted. Complete copies may be obtained from the American Standards Association, 29 W. 39th St., New York City.

Huge Mesta Planer Installed by Erie Foundry Company

To facilitate machining parts for large-sized steam hammers, the Erie Foundry Co., Erie, Pa., has installed a specially designed planer that is probably the largest in the United States and the heaviest in the world. Parts for the largest steam hammers that can be transported by present railroad facilities can be handled on this machine.

This planer, built by the Mesta Machine Co., Pittsburgh, Pa., is of the conventional double-housing type, and measures 16 feet 6 inches between the housings by 14 feet 3 inches from the table to the under side of the rail. The table is 35 feet 10 inches in length, weighs 100 tons, and runs on three ways—a V-way in the middle and a flat way at each side. The final table drive is through two racks, one on each side of the middle vee. The total weight of the planer is approximately 900,000 pounds, a weight which, as far as can be ascertained, exceeds that of any planer previously built in the world.

The drive and speed control are the largest of their type that have ever been built. The main motor drives the table through worm and spiral gear reductions. The motor has a nominal rating of 75 H.P., and under some speed and torque conditions will deliver twice this power. It is cooled by a separately driven blower. A speed range of 3.2 feet per minute up to 96 feet per minute is available in both the cutting and return directions. Individual electric feeds are provided for each head, with the feed per stroke ranging from 1/64 inch to 1 1/2 inches. Each head is also furnished with pneumatic tool-lifters.



Huge Mesta Planer, Installed by Erie Foundry Co., Set up for Machining the Frame for an Erie 50,000-pound Steam Drop-hammer

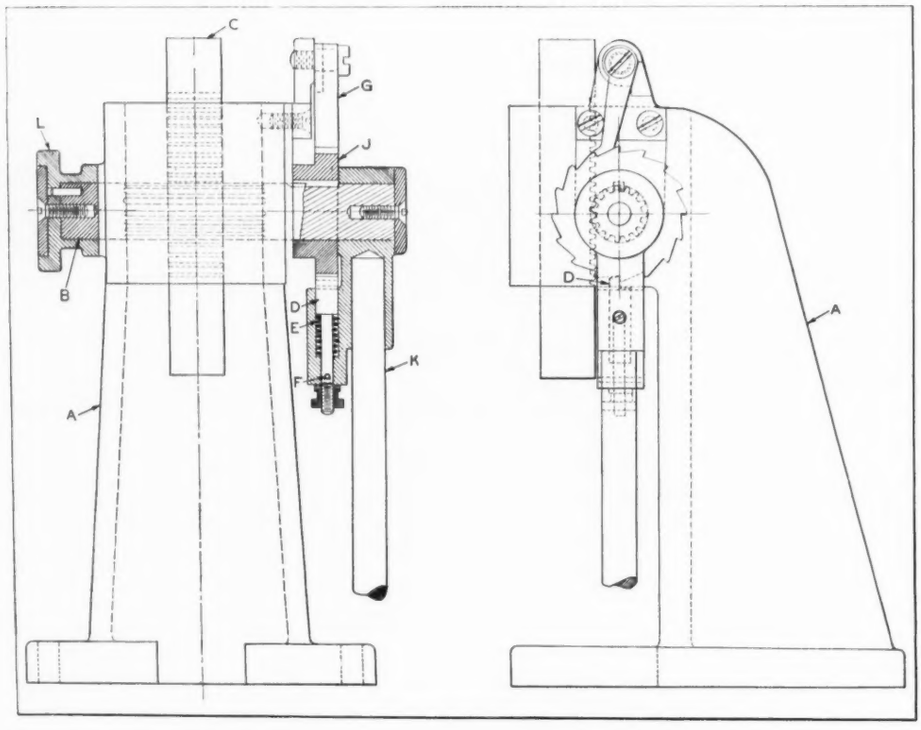
Arbor Press with Locking Device for Assembling Operation

By VINCENT WAITKUS

In a special hand assembling operation, it was necessary to compress a heavy elastic material and keep it in the compressed state while certain operations were being performed to complete the assembly. The accompanying illustration shows the press that was designed for this purpose.

The main bracket *A* supports a pinion-shaft *B* which operates the gear rack on ram *C*. The pinion-shaft is actuated by knob *L* mounted on one end of it. On the other end of the pinion-shaft is a ratchet *J* which is engaged by pawls *D* and *G*.

The operation is quite simple. The operator first adjusts ram *C* to the correct height over the work to be compressed by turning knob *L* which actuates the rack-and-pinion mechanism. In order to do this, pawl *D* must be withdrawn from the ratchet and turned 90 degrees, so that pin *F* will hold it out of engagement with the ratchet. When the ram is in the correct position, pawl *D* is released, the spring causing it to snap back into engagement with the ratchet. Ram *C* is now forced down by lever *K* to compress the work. Because of the fact that the material is very elastic, an auxiliary pawl *G* is provided to lock the ram in the down position. This arrangement leaves both of the operator's hands free for performing subsequent assembling operations, which was the main object to be accomplished by the arrangement.



Arbor Press with Ratchet and Pawl for Locking Ram in Down Position while Compressing an Elastic Material for Performing Assembling Operations

"Weldor" is Proposed as Name for Men Who Weld

The Weldor's Stabilizer, published by the Lincoln Electric Co., Cleveland, Ohio, recently contained these paragraphs which bring up an interesting subject.

"An advertisement 'Welder wanted for work in heavy steel production' brought replies from 42 men who sought employment and from 17 manufacturers' agents who offered welding sets of large amperage.

"That experience, as well as those of others, calls for a new word in the welding industry to distinguish the machine which furnishes the welding energy from the person who understands the art of welding.

"Some welding technicians tell us that they never refer to the person who welds as a welder; the person who welds, they say, is always referred to as a *welding operator*.

"The term 'welding operator' is not indicative of the specialized skill of hand or preparation of mind which must be possessed by the successful person who welds.

"Operator reflects a pusher of levers, a turner of cranks, a presser of buttons, the levers or the cranks or the buttons initiating a sequence of predetermined automatic functions, all of which may be beyond the choice or the control of the operator, once his function of pushing or turning or pressing is performed.

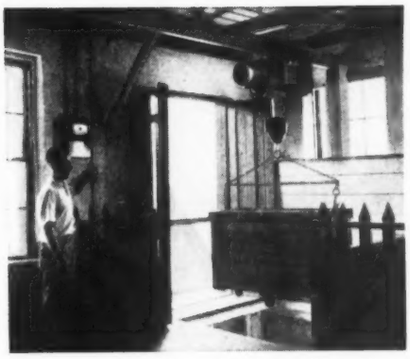
"The term 'welding operator' might properly be used to denote the man who treads the pedal which releases the stroke of a giant spot welder; but to use the same term to designate a person skilled manually and trained mentally to carry out an intricate procedure under exacting conditions, calling for choice and selection of position, posture and poise and definite manual movement on the part of the workman, is surely a misnomer.

"The terminology of the welding industry could be enlarged, and we are offering the word 'weldor' to displace entirely the term 'welding operator' for use in referring to the person who welds."

It certainly seems desirable that there should be a distinction of terms in this case.

Electric Hoist Operated Like an Elevator

Inexpensive elevator service for materials was recently obtained in a plant by the installation of an electric hoist. The accompanying illustration shows a Pawling & Harnischfeger electric hoist permanently installed over an elevator well. The hoist is used for lifting and lowering material in portable boxes from the basement to all the floors in the building. Push-button control at all the floor levels permits of easy operation. This idea is adaptable to cases where the volume of business may not warrant investment in a complete elevator, but where a speedy and efficient means for handling materials is desirable. It solves this problem effectively.



Electric Hoist Provides Inexpensive Elevator Service from Floor to Floor for Handling Materials

* * *

A Monument to the Founder of Scientific Engineering Methods

The Intercollegiate Rankine Memorial Movement has for its object to collect, from the 75,000 to 80,000 students in the engineering colleges of the United States, a fund of $15,000 to erect at the University of Glasgow, Scotland, a memorial to the late Professor Rankine, chief among the founders of modern scientific engineering. The dean of engineering at each college will be requested to appoint a suitable member of the faculty to cooperate with the student engineering organizations in promoting this object. For further information address Professor William H. Rasche, Virginia Polytechnic Institute, Blacksburg, Va.

* * *

Homemade Equipment May be Dangerous

In an article entitled "Flirting with Trouble," *Oxy-Acetylene Tips* calls attention to the danger of homemade acetylene generators. In spite of warnings to the contrary, there are people who occasionally try to make their own acetylene generators. In practically every instance on record, these homemade generators eventually cause difficulties, and, frequently, more or less serious accidents are due to the use of this homemade equipment.

Only generators listed by the Underwriters' Laboratories, Inc., or by the Factory Mutual Laboratories, should be used.

A Precaution in Buying Patent Rights

H. A. Toulmin, Jr., in a recent interview, mentioned the following difficulty of a manufacturer in connection with the buying of patent rights. This manufacturer decided to acquire a patent from an inventor. He obtained the assignment to the patent and immediately put it in his safety deposit box. On the face of the assignmnent it said the inventor had sold to the manufacturer the entire rights, title, and interest to the patent.

Not so long after this the inventor, being hard pressed for funds, sold the same patent over again to another manufacturer. This manufacturer looked up the official records, and finding no note of any previous transfer, paid his money and received the assignment. Then he did what the first buyer had failed to do—he recorded the transfer.

When the first buyer learned what had happened, he naturally tried to have the second sale annulled. But the law said in effect: "Sorry—you did not record the assignment within three months, according to the law. This makes the second buyer innocent, because the government records could not inform him of the previous assignment. This means, under the law, he is the real owner of the patent."

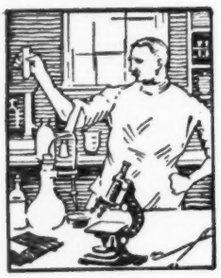
* * *

Packaging Machinery Competition

The annual All-America Package Competition, sponsored by *Modern Packaging Magazine*, has just been announced. Two of the classifications in this competition include packaging machinery and equipment, one relating to the best individual machine, and the other to the best production line. The competition closes December 30. Complete information may be obtained from the All-America Package Competition, 122 E. 42nd St., New York.

A 22-inch High Exact Reproduction and Working Model of a Regular Three-way Broaching Machine Built by the American Broach & Machine Co., Ann Arbor, Mich. The Machine Has a Complete Hydraulic System the Same as the Full-sized Machine. The Young Man with One Hand on the Operating Lever is of the Fourth Generation of Lapointes. The Family has been Engaged in the Broaching Machine Industry Since the First Lapointe Machine was Built in 1900 by J. N. Lapointe

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Plain Gray Iron with Tensile Strength of 40,000 Pounds per Square Inch

Pomoloy is the trade name that has been given to an unalloyed cast iron with remarkable physical properties which has been produced by the Pomona Pump Co., Pomona, Calif. This gray iron comes under the A.S.T.M. Specification A48-36, which includes all general gray-iron castings in which strength is a consideration. The C-2 iron (in Class 40 of the specification) has a tensile strength of 40,000 pounds per square inch and a hardness of 215 Brinell. Pomoloy is also made in a C-3 iron which falls in Class 50 of the specification mentioned.

Density, durability, and resistance to corrosion are other characteristics of Pomoloy, which is used in all pumps manufactured by the concern. The high physical properties are said to be obtained by a careful control of the materials used and of the foundry processes, rather than by the addition of strength-producing alloys.

Pomoloy machines readily to a smooth, close-grained surface which shows a minimum of graphite, with the tiny flakes thoroughly dispersed throughout the structure. Machined surfaces can be highly polished. This iron can be hardened by heat-treating methods or by the oxy-acetylene process. It cools at higher temperatures than ordinary cast iron and requires modification of the usual gray-iron gating and feeding practice in the foundry.....201

A Spring Made from Pomoloy Cast Iron will Resume Its Original Shape after being Bent into a U, Stretched, or Compressed

Illium Now Available in Strip, Tubing, and Bar Stock

Castings made from the alloy Illium, a product of the Burgess-Parr Co., Freeport, Ill., have been used for over twenty years in the chemical industry because of the resistance which the alloy offers to attack by the great majority of industrial corrosives. After this long period of service in the form of castings, Illium has now been made available in strip, tubing, and rolled bar stock for applications not previously possible. The alloy has a nickel-chromium base.

In addition to corrosion-resistance, the alloy possesses physical properties equal to those of many standard ferrous alloys. For example, the tensile strength of Illium-G, which is used for castings, ranges from 60,000 to 73,000 pounds per square inch; and the tensile strength of work-hardened Illium-R, from which strip, welded tubing, and rolled rods are produced, ranges from 140,000 to 150,000 pounds per square inch. Illium-R in the annealed condition has a tensile strength of from 95,000 to 105,000 pounds per square inch. The Brinell hardness of Illium-G is from 170 to 220, of Illium-R work-hardened, from 340 to 365, and of Illium-R annealed, from 175 to 240.

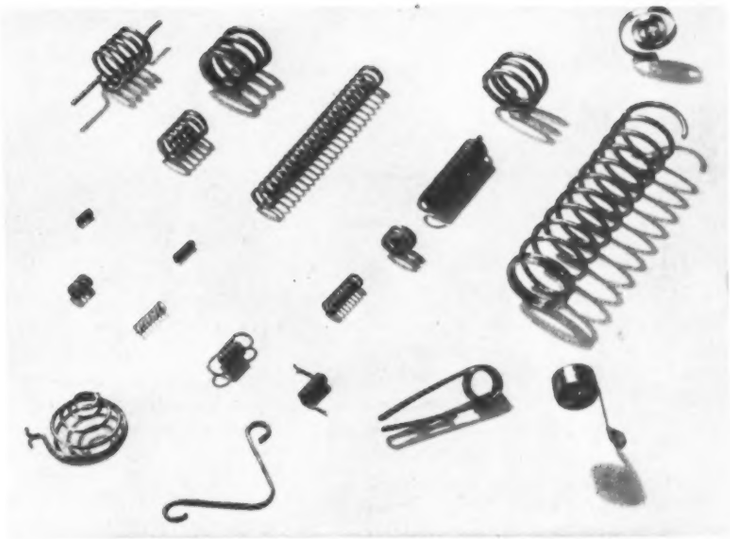
Illium possesses approximately the same machinability as stainless steel. Grinding may be accomplished without difficulty; however, the non-magnetic property of the alloy prevents the use of magnetic chucks in such operations. The

To obtain additional information about materials described on this page, see lower part of page 46.

alloy may be welded by means of the acetylene, electric arc, or atomic hydrogen arc processes.

Drawing and forming of Illium-R strip may be accomplished if the hardness is below 240 Brinell. Intermediate annealing is sometimes necessary if the draw is deep. Annealing is accomplished by bringing the alloy up to a temperature of 1900 degrees F. and allowing it to remain at this temperature for from three to five minutes.

Strip stock of Illium-R is available in limited widths and lengths and in gages from 8 to 34. It can be furnished in various hardnesses suitable for drawing, perforating, stamping, and other fabrication methods. Rolled rod is available either as-rolled or with a machined or ground finish. This rod material has been found particularly suitable for use as tie-rods, light shafting, screw-machine stock, and small hardware. Wire can be supplied in limited quantities in any standard gage. Cast bars can also be provided in hexagonal, round, and square shapes, as well as centrifugally cast tubes. 202



Some of the Forms and Sizes of Springs Made from Beryllium-copper Wire by the Instrument Specialties Co., Inc.

Stainless Steels Used for Pumps Handling Corrosive Liquids

Pumps made of several corrosion-resisting alloy steels for the handling of corrosive liquids, have recently been brought out by the Duriron Co., Dayton, Ohio. For handling weak sulphuric and other acids, chlorine bleach solutions, and caustics, pumps are made of Durimet, a nickel-chromium-molybdenum low-carbon steel; for handling nitric and fruit acids, from Durco KA2S, an 18 per cent chromium, 8 per cent nickel low-carbon steel; for handling pulp cooking liquors and phosphoric acid, from Durco KA2SMo, an 18 per cent chromium, 8 per cent nickel, 3 per cent molybdenum low-carbon steel. These corrosion-resisting alloys are used for all parts that come into contact with the corrosive liquids. 203

Beryllium-Copper Springs Made to Meet Precision Requirements

Coil springs made from beryllium-copper within unusually close tolerances as to diameter, length, and rate of deflection have been made available through the development of production and heat-treating methods by the Instrument Specialties Co., Inc., Little Falls, N. J. Springs up to 1 1/4 inch in diameter or length can be regularly made with a diameter tolerance of 0.001 inch, a length tolerance of 0.002 inch, and a deflection rate of 5 per cent; springs from 1/4 to 1 inch in diameter or length can be made with a diameter tolerance of 0.002 inch, a length tolerance of 0.005 inch, and a deflection rate of 3 per cent; and springs more than 1 inch in diameter or length can be made with a diameter tolerance of 0.003 inch, a length tolerance of 0.010 inch, and a deflection rate of 2 per cent. Still closer tolerances are obtainable with most types of springs at an increase in cost.

The present facilities of the concern are suited to the quantity production of springs from wire up to 1/8 inch diameter, having a maximum coil diameter of 2 inches and a maximum length of 10 inches. Some of the styles already produced are here illustrated. A complete stock of tested beryllium-copper wire in all B & S sizes of 0.009 to 0.1285 inch is maintained to meet requirements. .204

Baking Enamel that Reproduces Metal Colorings on Polished Parts

A baking enamel by means of which any polished metal can be made to resemble brass, chemically treated aluminum and steel, and other metals, has been developed by the Maas & Waldstein Co., Newark, N. J. This new enamel, which is known as "Baking Platelustre," is said to resist the action of cleaning operations and also of nickel, chromium, and other plating baths, so that a wide variety of effects can be obtained on parts by sectional application of the enamel.

Flat stock finished with the enamel can be formed after the baking. The enamel can be applied to polished metal by spraying or roller coating. It is especially suitable for use in the manufacture of lighting fixtures, compacts, novelties, and other products on which a brilliant metallic finish is desirable. 205

To obtain additional information about materials described on this page, see lower part of page 46.

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 45 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the September Number of MACHINERY

Electric Furnaces

AJAX ELECTROTHERMIC CORPORATION, Trenton, N. J. Folder T-5, showing Ajax Northrup electric furnaces in ten colleges, with statements of uses in each by professors and graduate students. Booklet T-6, showing thirteen applications of high-frequency induction heating in thirteen different industries. Bulletin 12, on small laboratory furnaces. Bulletin 13, on high-frequency heating for forging, hardening, brazing, etc. 1

Electric Control Equipment

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia, Pa. Folder N-33, announcing a demonstration machine built to show why Micromax pyrometers improve automatic control of furnace temperatures, etc. Leaflet descriptive of a new direct-reading optical pyrometer and the Rayotube temperature detector. 2

Variable-Speed Transmission

LINK-BELT CO., 307 N. Michigan Ave., Chicago, Ill. Book 1574, containing information on the construction and application of the Link-Belt P.I.V. gear, a positive infinitely variable-speed transmission applicable to a variety of purposes, including machine tools. Speed and horsepower tables are included. 3

High-Nickel Alloys

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Booklet entitled "Tremendous Trifles," presenting technical and mechanical data on nickel, Monel, K-Monel, and Z-nickel, as used for such parts as springs, bolts, and electrical contact points that are subjected to severe service conditions. 4

Polishing and Buffing Equipment

CONTINENTAL ROLL & STEEL FOUNDRY CO., Industrial Equipment Division, 14400 Railroad Ave., East Chicago, Ind. Bulletin on Continental semi-automatic polishing and buffing heads for use with standard double-spindle lathes; especially adapted for oval or irregular-shaped work. 5

Mechanical Rubber Goods

MANHATTAN RUBBER MFG. DIVISION OF RAYBESTOS-MANHATTAN INC., 94 Townsend St., Passaic, N. J. Condensed catalogue of mechanical rubber goods, including belting, hose, packing, molded rubber goods, industrial asbestos friction material, etc. Engineering data and technical information are included. 6

Roller Bearings

TIMKEN ROLLER BEARING CO., Canton, Ohio. Bulletin entitled "The World of Tomorrow Rolls on Timken Roller Bearings Today," illustrating the use of Timken bearings in locomotives and other modern railroad rolling stock, as exhibited at the New York World's Fair. 7

Stressproof Steel

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill. Bulletin describing the qualities of "Stressproof" No. 2 steel, a non-warping shafting and machinery steel combining high strength, free machinability, and superior wearing qualities. 8

Taps and Dies

DETROIT TAP AND TOOL CO., 8400 Butler St., Detroit, Mich. Catalogue entitled "Detroit Ground," giving complete data, including prices, on the company's line of taps, gages, dies, tap maintenance equipment, threading tools, etc. A section is included on precision grinding. 9

Reset Timing Relay

EAGLE SIGNAL CORPORATION, Moline, Ill. Bulletin 260, describing the Multiflex instantaneous reset timers, especially designed for applications requiring one or more contact operations in a timed sequence. Suitable for controlling operations on automatic machine tools. 10

Machine Shop Tools

ARMSTRONG BROS. TOOL CO., 313 N. Francisco Ave., Chicago, Ill. General Catalogue No. C-39, covering tool-holders, socket wrenches, C-clamps, lathe and milling machine dogs, turret lathe and screw machine tools, ratchet drills, bits, blades, setting-up tools, and pipe tools. 11

Welding and Lead-Burning Equipment

IMPERIAL BRASS MFG. CO., 1200 W. Harrison St., Chicago, Ill. Catalogue 334, showing the Imperial line of oxy-acetylene and oxy-hydrogen welding, cutting, brazing and lead-burning equipment, as well as soldering equipment, torches, and supplies. 12

Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletins GEA-2080, 3071A, and 3085A, treating, respectively, of alternating- and direct-current solenoids, Diesel-electric industrial locomotives, and single-phase oil-immersed distribution transformers. 13

Electric Adjustable-Speed Drives

RELIANCE ELECTRIC & ENGINEERING CO., 1077 Ivanhoe Road, Cleveland, Ohio. Bulletin 307, describing the Reliance Type VS all-electric adjustable-speed drive, and illustrating its application in the machine tool and other industries. 14

Shop Accessories

J. A. HONEGGER & ASSOCIATES, 223 Spruce St., Bloomfield, N. J. Circular describing the "Jiffybob," an inexpensive plumb bob that has the cord wound up inside the bob. Circular on the "Kompact Stylo" oiler, for oiling small machinery, equipment, and devices. 15

Motorized Speed Reducers

BOSTON GEAR WORKS, INC., North Quincy, Mass. Sales data folder 8602, announcing the new straight-in-line Type SME "Ratiomotor," a reduction unit suitable for many applications where a high-speed motor cannot be used. 16

Contour Sawing and Filing Machines

CONTINENTAL MACHINES, INC., 1301 Washington Ave. S., Minneapolis, Minn. "Doall Digest," showing many different examples of contour machining performed on Doall machines, submitted by users. 17

Machine-Tool Spindle Roller Bearings

S K F INDUSTRIES, INC., Philadelphia, Pa. Catalogue 250, illustrating and describing S K F double-row cylindrical roller bearings, and typical mountings on various classes of machine tools. 18

Centrifugal Separating Machines

SHARPLES CORPORATION, 2336 Westmoreland St., Philadelphia, Pa. Bulletin 1225, descriptive of Sharples super-centrifuges, a group of separating machines developing an extremely high degree of centrifugal force. 19

Stainless-Steel Castings

ATLAS STAINLESS STEEL CASTINGS, DIVISION OF ATLAS FOUNDRY CO., Irvington, N. J. Folder outlining the characteristics of Atlas stainless steel castings and containing a list of the many uses of this metal in various industries. 20

Slip-Roll Forming Machines

NIAGARA MACHINE & TOOL WORKS, 637 Northland Ave., Buffalo, N. Y. Bulletin 77-A, describing the complete line of Niagara slip-roll forming machines with trigger release arrangement for easy removal of work. 21

Oil-Gage Plugs

GITS BROS. MFG. CO., 1858 S. Kilbourn Ave., Chicago, Ill. Leaflet descriptive of Gits brass oil-gage plugs for gear-cases, available in two styles — the BW hexagon with threaded shank, and the CW round with flush mounting. 22

Electric Eye Control

PHOTOSWITCH, INC., 21 Chestnut St., Cambridge, Mass. Catalogue illustrating typical applications of the Photoswitch, an electric eye control adapted for a wide range of industrial uses, including counting, inspection, safeguards, etc. 23

Upset Forgings

AMERICAN FORGE DIVISION OF AMERICAN BRAKE SHOE AND FOUNDRY CO., 2621 S. Hoyne Ave., Chicago, Ill. Booklet entitled "Judge Amforge Holds a Radio Quiz," presenting facts about upset forgings in an unusual way. 24

Oil-Less Bearings

BOUND BROOK OIL-LESS BEARING CO., Bound Brook, N. J. Data for loose-leaf catalogue, listing sleeve type, flanged, and special bearings for which the company has tools and dies ready for immediate production. 25

Gear-Finishing Machines

FELLOWS GEAR SHAPER CO., 78 River St., Springfield, Vt. Circular illustrating and describing the new No. 18 Fellows gear-finishing machine for finishing external spur and helical gears. 26

Hydraulic Broaching Machines

OILGEAR CO., 1315A W. Bruce St., Milwaukee, Wis. Bulletin 20000, illustrating and describing the new Oilgear line of Type XL fluid-power, variable-speed, horizontal broaching machines. 27

Gaskets

METALLO GASKET CO., New Brunswick, N. J. Catalogue containing data, including dimensions and list prices, covering metal gaskets, made in different constructions to suit various requirements. 28

Belting

MECHANICAL GOODS DIVISION OF THE U. S. RUBBER CO., 1790 Broad-

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To Obtain Copies of New Trade Literature

listed on pages 44-46 (without charge or obligation) mark with X in the squares below, the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	

Name ..... *Position or Title* .....

[This service is for those in charge of shop or engineering work.]

Firm .....

Business Address .....

City ..... *State* .....

[SEE OTHER SIDE]

way, New York City. Catalogue entitled "Belting Biographies," describing the company's line of transmission and conveyor belts. 29

Electric Equipment

GENERAL ELECTRIC Co., Schenectady, N. Y. Bulletin GEA-2420, 2426B and 2596A, describing, respectively, capacitor-motors for pumps; oil-blast circuit-breakers; and metal-enclosed switchgear with draw-out air circuit-breakers. 30

Gear-Cutting Machines

FARREL-BIRMINGHAM CO., INC., 344 Vulcan St., Buffalo, N. Y. Bulletin No. 442, illustrating and describing the Sykes 2-C gear-generating machine, completely covering features of design and operation. 31

Bronze Bars

JOHNSON BRONZE CO., 520 S. Mill St., New Castle, Pa. List of Johnson Universal bronze bars and tubes arranged in a most unusual type of booklet, giving the several hundred sizes carried in stock. 32

Conveying Systems

METZGAR CO., Grand Rapids, Mich. Folder illustrating and describing the Metzgar wheel conveying systems, portable and fixed types, suitable for all kinds of industries. 33

Electric Power Control

SUPERIOR ELECTRIC CO., Bristol, Conn. Bulletin No. 148, illustrating and describing a new variable-voltage transformer known as the "Powerstat." 34

Heat-Resisting Welding Compound

MILLER MFG. CO., Camden, N. J. Circular describing "Wonder Weld" heat-resisting compound for concentrating heat at any given spot in welding, in order to protect adjacent parts. 35

Recessed-Head Screws and Bolts

PHEOLL MFG. CO., 5700 Roosevelt Road, Chicago, Ill. Circular 639, descriptive of the Pheoll-Phillips recessed-head screws and bolts, designed to speed up assembly. 36

Grinding of Carbide Tools

MCKENNA METALS CO., 147 Lloyd Ave., Latrobe, Pa. Wall chart containing instructions for the correct grinding of Kennametal steel-cutting carbide tools. 37

Welding Equipment

HOBART BROS. CO., Troy, Ohio. Folder illustrating and describing a new low-cost alternating-current arc-welding machine known as the "Transarc." 38

Electric Hoists

MASTER ELECTRIC CO., Dayton, Ohio. Catalogue containing data on Speedmaster electric hoists, designed to give high speed at low cost. 39

Automatic Bar Machines

NATIONAL ACME CO., Cleveland, Ohio. Catalogue M-40, illustrating and describing the Acme-Gridley Model RA four-, six-, and eight-spindle automatic bar machines. 40

Die-Casting Machines

KUX-LOHNER MACHINE CO., 2147 Lexington St., Chicago, Ill. Circular illustrating and describing Kux high-speed die-casting machines for lead, tin, and zinc base alloys. 41

Inclinable Power Presses

V & O PRESS CO., INC., Hudson, N. Y. Catalogue 39, covering the V & O line of inclinable open-back presses, made in twenty-three sizes to suit a wide variety of work. 42

Power Transmission Equipment

MORSE CHAIN CO., Ithaca, N. Y. Bulletin 75, containing descriptions and design data covering the Morse roller chain drives and other transmission equipment. 43

Electric Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Leaflet F-8496, descriptive of a general-utility motor for workshop or home. 44

Bolts, Nuts, Screws, and Rivets

CLARK BROS. BOLT CO., Milldale, Conn. Catalogue and reference book No. 39, covering bolts, nuts, screws, and rivets. 45

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 47-62 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment mark with X in the squares below, the identifying number found at the end of each description on pages 47-62—or write directly to the manufacturer, mentioning machine as described in September MACHINERY.

51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 42-43 mark with X in the squares below, the identifying number found at end of each description on pages 42-43—or write directly to the manufacturer, mentioning name of material as described in September MACHINERY.

201	202	203	204	205

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

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Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

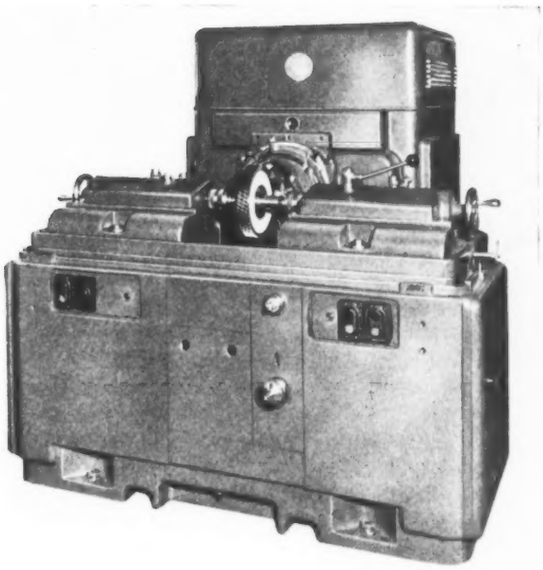


Fig. 1. Fellows No. 18 Gear-finishing Machine for External Spur and Helical Gears

Fellows Gear-Finishing Machine for Spur and Helical Gears

The Fellows Gear Shaper Co., 78 River St., Springfield, Vt., has recently placed on the market a new machine for finishing external spur and helical gears by a process employing a rapidly reciprocating rotary finishing tool. As shown in Fig. 1, this machine is provided with headstock and tailstock slides, and headstock and tailstock spindles, the latter carrying "live" centers upon which the work is mounted. When the work is of the integral shank type, it is held directly on the centers; and, when it is provided with a hole, it is supported on an arbor which is, in turn, placed on the centers of the gear-finishing machine.

The rotary finishing tool is held in an adjustable head that can be set to any desired angle for finishing both spur and helical gears. This head is mounted on a slide which is reciprocated rapidly. The rapid reciprocation of the tool greatly enhances the cutting action and permits the removal of considerable material and the production of a fine finish on the work. The combination of rapid reciprocation and high-speed rotation also results in the production of extremely accurate gears as to tooth shapes, spacing, etc.

Another interesting feature of this machine is its ability to employ two distinct methods of operation. The axis of the tool can be set at an angle with relation to the axis of the work, and the gear finished by what is known as the "crossed axes" method; or the axes of the tool and the work can be set parallel to each other and the gear finished by what is known as the "parallel axes" method. The latter method is particularly advantageous in finishing shoulder or cluster gears, where it is necessary for the tool to operate close to a shoulder.

Fig. 2 shows the set-up for finishing an external helical gear by the "crossed axes" method. The tool can have either straight or helical teeth, depending on the direction of the

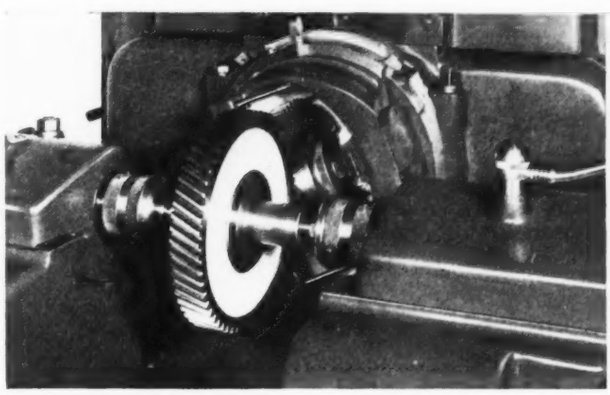


Fig. 2. Finishing an External Helical Gear by the "Crossed Axes" Method

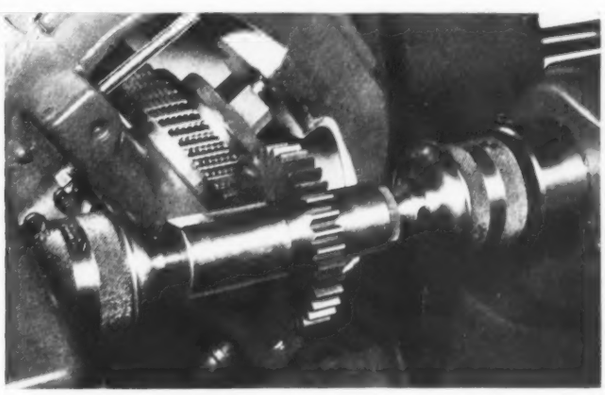


Fig. 3. Finishing an External Spur Gear by the "Crossed Axes" Method

To obtain additional information on equipment described on this page, see lower part of page 46.

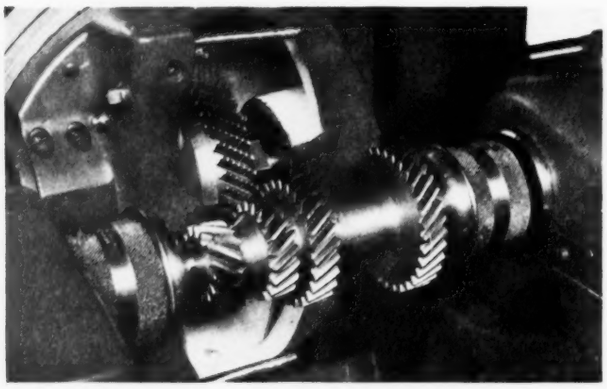


Fig. 4. Finishing a Shoulder or Cluster Helical Gear on Fellows Machine by the "Parallel Axes" Method

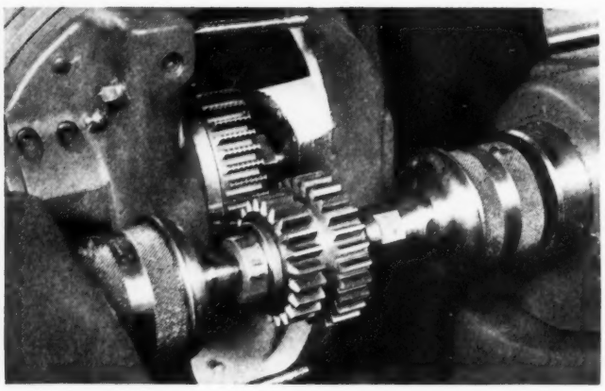


Fig. 5. Fellows Gear-finishing Machine Set up for Finishing a Cluster Spur Gear by "Parallel Axes" Method

teeth on the gear relative to the gear axis, and the necessary "crossed axes" setting required to give the best results.

Fig. 3 shows the set-up for finishing a spur gear. In this case, the "crossed axes" method is employed and a helical-tooth tool must be used. The cluster helical gear shown in Fig. 4 is being finished by the "parallel axes" method, using a helical-tooth tool. In Fig. 5 is shown a spur cluster gear being finished by the "parallel axes" method. In employing the "parallel axes" method, a spur-tooth tool is always used for spur gears and a helical-tooth tool for helical gears. This has an advantage, particularly in the finishing of spur gears, in that one tool can be used for finishing gears having a large range in numbers of teeth, as long as they are of the same tooth proportions.

The machine is provided with complete electrical control, having two control panels, one of which is employed when setting up the machine and the other when operating it. The finishing tool is advanced toward the work by means of a feed-cam. The electrical control can be set to give the required number of reciprocating cycles, the number depending on the diameter of the work, pitch, and other factors. The machine stops automatically when the cycle has been completed.

The machine has a capacity for spur and helical gears up to 18 inches pitch diameter and 5 inches face width. The cutting time, of course, is controlled by change-gears, and the range is from 25 seconds to 10 minutes. 51

Sundstrand Automatic Stub Lathes Now Built in Three Models

An automatic stub lathe (the Model 10) was introduced by the Sundstrand Machine Tool Co., 2530 Eleventh St., Rockford, Ill., at the exhibit of the National Machine Tool Builders Association in 1935. Subsequently, the smaller Model 8 was brought out, and recently a Model 12, which has been installed in a considerable number of shops.

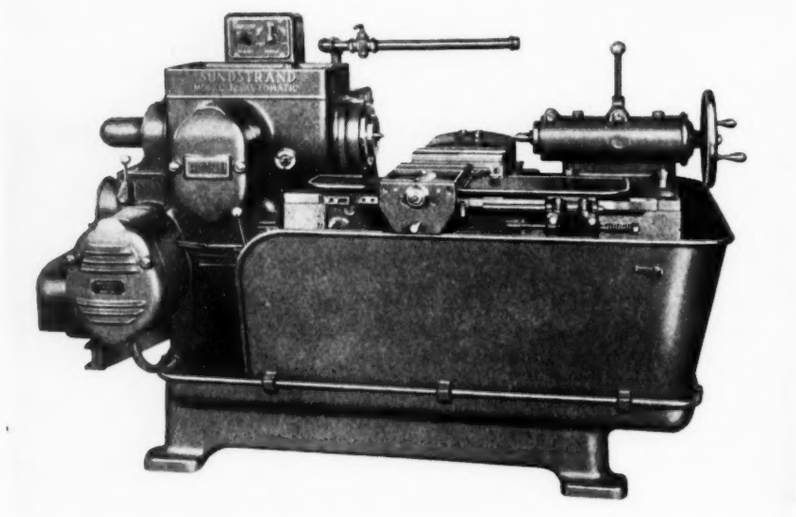


Fig. 1. Sundstrand Model 12 Automatic Stub Lathe

All three models of the Sundstrand automatic stub lathe have an operating cycle that is fully automatic from the time that the tools on the front carriage and the rear slide start their movement until they have completed the cut and returned to the starting position. The operating cycle includes a rapid approach at the rate of 250 inches per minute; an in-feed to depth for turning and facing; tool relief; quick return, also at the rate of 250 inches per minute; and stopping.

An outstanding feature of these machines is the simple cycle control by means of which various cycles can be obtained by merely adjusting dogs around a disk. The edge of the disk is graduated to aid the operator in making adjustments. Three dogs suffice to control the cycles most frequently used.

A wide range of action is provided for the front carriage tools by three units, which can be used separately or in combination. These units give an angular feed-in and tool relief (*A*, Fig. 2); a slow-up and dwell (*B*); and a straight feed-in and tool relief (*C*). The rear slide can also be provided with angular feed-in and tool relief.

The Models 10 and 12 automatic stub lathes are of the same capa-

To obtain additional information on equipment described on this page, see lower part of page 46.

cities, but the Models 8 and 10 have a 6-inch Type A2 spindle nose, while the Model 12 has an 8-inch nose of the same type. The Models 10 and 12 have a standard swing over the cross-slide of 10 1/2 inches diameter and a maximum swing of 12 inches; a maximum swing over the carriage of 13 1/2 inches; and a maximum swing over the carriage ways of 16 1/4 inches. The carriage has a maximum longitudinal feed, with the angular feed-in, of 11 inches, and with the straight feed-in, of 5 5/8 inches, the maximum straight feed-in being 2 inches. The front carriage is 22 inches long, and the rear slide 21 1/2 inches long.

Model 8 has a maximum swing over the cross-slide of 9 inches diameter, but a swing of 11 inches can be provided for. The maximum swing over the front carriage is 12 1/2 inches, and over the carriage ways 15 1/4 inches. The front carriage has a maximum longitudinal feed, with the angular feed-in, of 9 1/4 inches, and with the straight feed-in, of 7 3/8 inches, the maximum straight feed-in being 1 1/2 inches. The front carriage is 18 1/4 inches long, and the rear slide is 16 1/4 inches long. 52

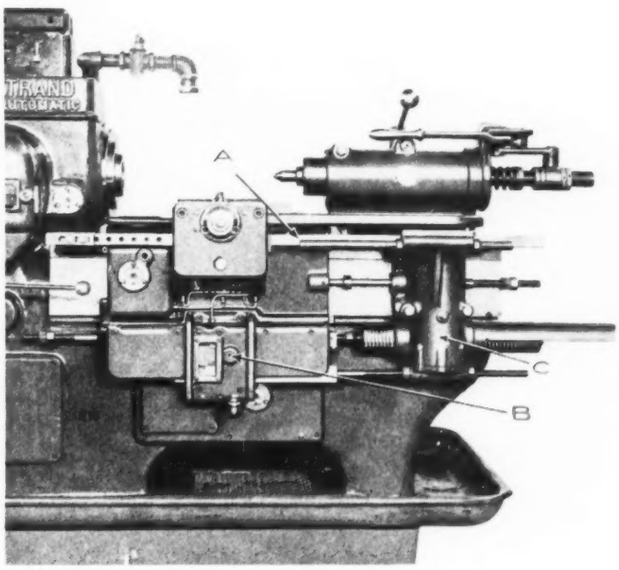


Fig. 2. Sundstrand Model 8 Automatic Stub Lathe with Feed-in and Tool Relief, Plus Slow-up and Dwell Units

Hewitt All-Neoprene Transmission Belts

After three years of experimentation, the Hewitt Rubber Corporation, 240 Kensington Ave., Buffalo, N. Y., has started manufacturing an all-Neoprene friction surface transmission belt. This belt will withstand the action of mineral oils, which are so destructive to ordinary rubber belts. The new product is known as "Duroil Hewprene" transmission belting. There is no natural rubber in these belts. They hold wire fasteners well. 53

Foster Brake-Drum Superfinishing Machine

A new semi-horizontal brake-drum superfinishing machine brought out by the Foster Machine Co., 802 Foster Bldg., Elkhart, Ind., has been installed recently in the plants of several automobile companies. The drum to be superfinished is located on an adapter that is fitted to the hub of the drum. The drum is held on the adapter by an air-operated draw-rod. In the operation of the machine, the lever at the upper right-hand side is engaged, automatically starting the spindle, which runs at a speed of approximately 150 R.P.M.

In the first part of the superfinishing cycle of operations, the roughing stones are automatically presented, under adjustable spring pressure, to the surface being finished. As the operation progresses, the finishing stones automatically come into operation shortly after the roughing stones are withdrawn. The final operation with the finishing stones requires only a few seconds. The total time required for the complete operation on an 11-inch drum is approximately fifteen seconds. At the end of the cycle, the stone slides move back into their starting positions and the spindle automatically stops to permit unloading.

The brake-drums are brought to the superfinishing machine in a finish-bored condition, the boring operation having been performed with a feed of approximately 0.020 inch per revolution. The brake-drum is superfinished to a profilometer reading of approximately 10 micro-inches. A surface showing a better micro-inch reading can be obtained by varying the cycle of the machine. A 10-micro-inch finish, however, is considered especially suited for brake-drum service. 54

Foster Brake-drum Superfinishing Machine with Automatically Controlled Roughing and Finishing Stones

Carboloy Tantalum and Titanium Carbide Tools

The Carboloy Company, Inc., 11147 E. Eight Mile Road, Detroit, Mich., has developed a Grade 78 special carbide cutting-tool material containing a combination of tungsten, tantalum, and titanium carbides. It is claimed that this material shows a marked improvement over previous grades of titanium carbide. It is used for taking cuts as heavy as 3/8 inch with feeds up to 3/64 inch

To obtain additional information on equipment described on this page, see lower part of page 46.

per revolution in machining steel bars and castings.

A typical example of the results obtained with this new material is found in its use for finish-turning eleven steps on an S A E 1045 steel shaft, 35 3/16 inches long, the steps varying from 1 1/4 to 2.78 inches in diameter. A Grade 78, Style 4 Carboloy tool completes this job in 18 minutes, representing a 45 per cent reduction in machining time over that required with the tools formerly used. A speed of 180 feet per minute with a feed of 0.020 inch per revolution was used. 55

Hanna High-Speed Pneumatic Riveter

The riveter here illustrated is the latest addition to the line of riveting machines manufactured by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. An outstanding feature of this machine is the speed of operation, which enables a complete riveting stroke, forward and return, to be made in less than one second. When operated at an air pressure of 80 pounds, this riveter exerts a pressure of 20 tons on the dies, which have a capacity for driving cold rivets up to 3/8 inch in diameter, and hot rivets up to 1/2 inch in diameter. A die stroke of any length up to 3 inches can be employed. This riveter will exert its rated pressure of 20 tons uniformly on the work, even though the variation in the length of the rivet and the thickness of the grip may vary as much as 3/8 inch.

The driving jaws are of the "alligator" or "nut-cracker" type, shaped to avoid interference with the assemblies being riveted. They are of simple design, inexpensive, and made of standard heat-treated alloy steel stock. They can be removed very quickly, and any number of stakes may be kept on hand to meet various requirements. The power of the air cylinder is multiplied and transmitted to the driving jaws through a hardened and ground alloy-steel wedge and anti-friction roller bearings. This construction insures economy in the amount of air consumed. The mechanism is entirely enclosed. 56

Colonial Pull-Down Broaching Machine

A pull-down broaching machine designed to simplify loading and unloading and to eliminate both manual and automatic handling of the broach on internal broaching operations has been brought out by the Colonial Broach Co., Detroit, Mich. The machine was developed primarily for broaching keyways in the taper holes of two steering-wheel hubs simultaneously. After the broach is pulled down through the work, the ram trips the release, causing the work-holding cradle to rise away from the broach at an angle under spring pressure. The work can then be removed without interference from the broach, and the work-holding cradle can be reloaded when the broach is in the "down" position. The ram next returns to the top of the stroke, the broach passing through the work but clearing it as a result of the angular offset of the raised fixture.

With the broach at the top, the work-holding cradle is lowered manually against spring pressure, locating the parts over a keyway horn, which also serves as a guide for the broach. The cradle is automatically locked in this position. Both hands must be on the dual safety controls to start the downward stroke. The stroke is adjustable by means of trip-dogs, the standard length being 24 inches. The rated capacity of the machine is four tons. The machine is operated hydraulically at a pressure of 1000 pounds per square inch by a constant-delivery pump. 57

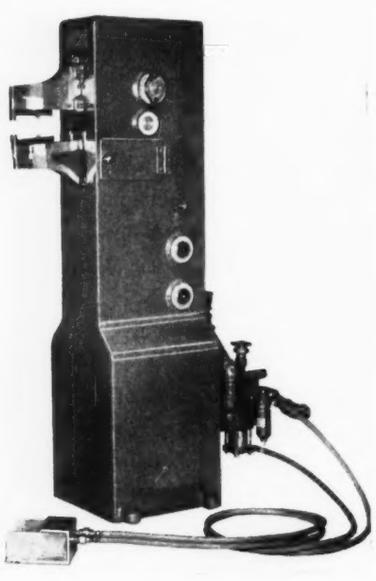
Attachment for Binder that Applies Tape to Edges of Drawings

In March, 1937, MACHINERY, page 492, a binder for applying tape to the edges of drawings, made by the Vertex Co., 5-7 Great Jones St., New York City, was illustrated and described. A simple attachment for this machine has now been placed on the market by means of which adhesive tapes of various widths can be applied along one side of tracings, blueprints, maps, etc. This attachment can be applied to machines already installed. The binding of the edge can now be performed in two ways—by folding the tape over the edge or by applying it on one side only along the edge of the drawing or blueprint. 58

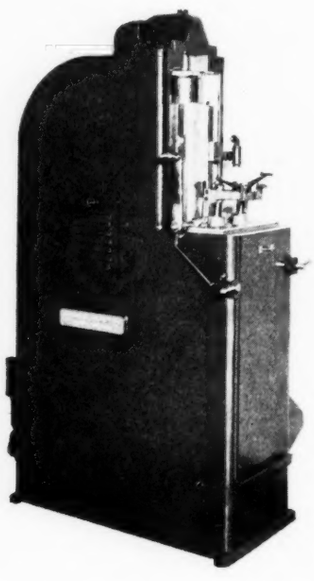
Black & Decker Electric Drills of Improved Design

The Black & Decker Mfg. Co., Towson, Md., has recently redesigned five of their portable electric drills, designated as the 1/2-inch Utility, 3/8-inch heavy-duty, 3/8-inch Utility, 5/16-inch heavy-duty, and 1/4-inch heavy-duty.

These improved drills are all shorter in length and lighter in weight than the preceding models in the same sizes. The spindle offset on each size has also been reduced to a minimum. Other improvements include: Threaded chuck mounting, and removable commutator covers. 59



Hanna Pneumatic Riveter Designed for High-speed Operation



Colonial Pull-down Broach Designed to Eliminate Broach Handling

To obtain additional information on equipment described on this page, see lower part of page 46.

Fig. 1. Crownless Press Placed on the Market by the Clearing Machine Corporation

Fig. 2. One of the Two Slide-driving Mechanisms, Enclosed in the Sides of Press Frame

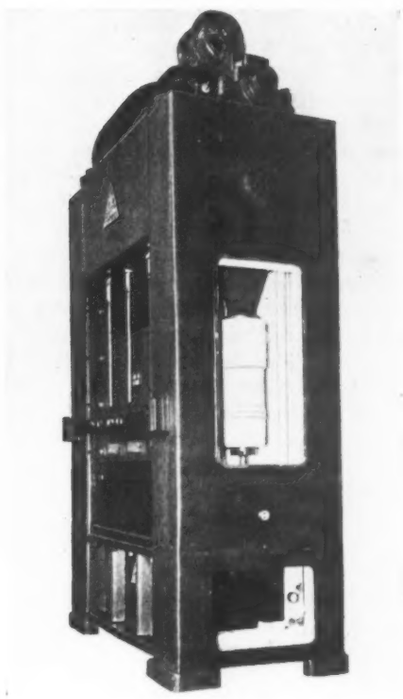


Fig. 3. View Showing Two Recesses for the Motor-starting Equipment and Slide-driving Mechanism

Clearing Crownless Presses

The Clearing Machine Corporation, 6499 W. 65th St., Chicago, Ill., is bringing out a power press of entirely new design which is adapted for a variety of deep drawing, embossing, and blanking operations on sheet metal. This press is designated as the "R" type to distinguish it from the somewhat special medium and large size presses previously built by this company for large plants in the automotive and other industries. The new "R" type press is being manufactured in widths ranging from 36 to 96 inches. It is also planned to build this machine in sizes ranging from 100 tons upward and in a variety of standardized sizes for small and medium size work.

An outstanding feature of this press is the crownless design, in which the conventional crown simply supports the driveshaft assembly and motor. With this construction, the crown serves merely as a spacer, there being no deflection in the crown member when the press slide reaches the bottom of its stroke. Breakage and excessive spoilage of the product, often caused by deflection of the crown, are thus eliminated, and there is less danger of damage to the press. Another feature is the "crankless" design of the slide-operating mechanism, shown in Figs. 2 and 3, which permits the gears and other driving parts to be enclosed within the welded steel structure, where they run immersed in oil.

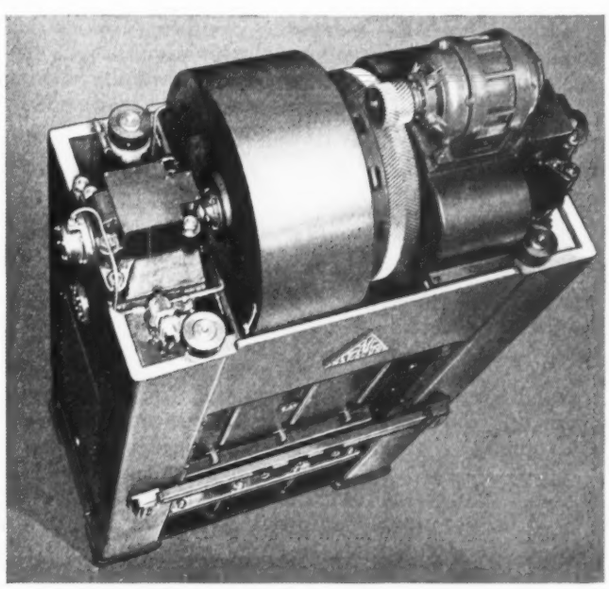


Fig. 4. View Looking Down on Flywheel and Clutch Assembly of Press Shown in Fig. 1

The streamline design of the press is shown in the front view, Fig. 1. Recesses at both ends of the bed, as shown in Fig. 3, are arranged to serve as housings for the motor-starting equipment and clutch controls and for the air-regulating valves provided for the operation of counterbalance cylinders or air cushions in the bed. All electrical wiring and air lines run through channels inside of the press frame.

The absence of overhanging parts on the press not only reduces the floor space required, but enables the machines to be placed closer together so that stampings can be handled more efficiently in passing them from one press to another. The dies can also be placed in or removed from the press from either the front or the back side with greater ease and safety.

To obtain additional information on equipment described on this page, see lower part of page 46.

The assembly of the gear and eccentric with the pitman and adjustment screw at the end of the slide is shown in Fig. 2. The adjustment screw enters a barrel type nut placed within an accurately machined housing. This arrangement prevents the screw from bending under stress. The position of the slide is adjusted by means of this nut, either a motor- or hand-operated adjusting mechanism being furnished, depending on the size of the press.

Fig. 4 shows a top view of the flywheel and clutch assembly. It will be noted that the drive-shaft is symmetrically placed on the center line of the press, distributing its power equally to the slide-actuating members. The flywheel rotates on antifriction bearings and is mounted on the same drive-shaft as the clutch and brake, which are air operated and electrically controlled. The clutch and brake are connected by a common hub which eliminates any lost motion between them.

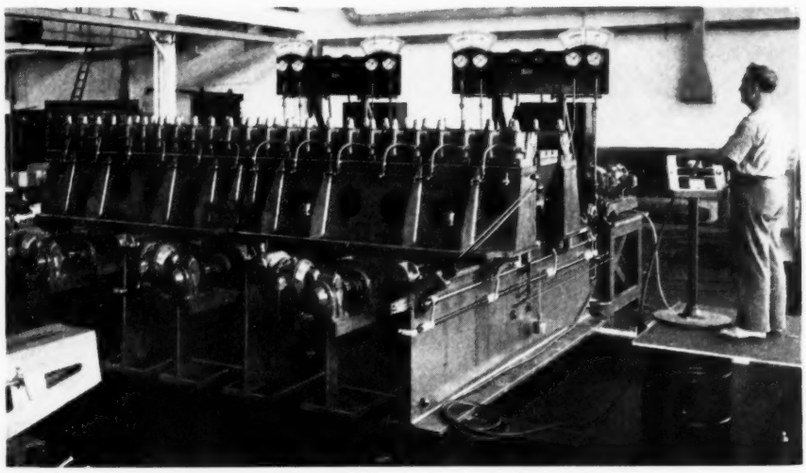
The beds of the presses are machined to receive air-cushion equipment, and the spacing member at the top of the press is machined for air counterbalance cylinders for the slide and dies, which can be added to the press when required. 60

Ruthman Gusher Coolant Pump

A new coolant pump developed to harmonize with modern trends in design has been brought out by the Ruthman Machinery Co., Cincinnati, Ohio. This pump is arranged with a flange for mounting on a pad on the side of the coolant reservoir. The 3-inch by 5 1/2-inch pump inlet opens directly into the reservoir, providing unrestricted gravity flow of the coolant. The pump discharges through an outlet in the center of the intake opening, so that the outlet pipe connections can be made internally, thus confining the piping or delivery passages to the inside of the machine housings.

Ruthman Gusher Pump Arranged for Flange Mounting

Twin suction intakes which connect independently with the upper and lower inlets to the impeller make possible a high operating efficiency. The double pumping action obtained by this arrangement maintains a hydrostatically balanced thrust which counteracts the weight of the vertical shaft. The pump is adapted for handling non-lubricating liquids, abrasive-carrying liquids, and all types of coolant compounds without injury. Equipped with a 1/2-H.P. motor, the pump will supply up to 50 gallons of coolant per minute, and with a 3/4-H.P. motor, 85 gallons per minute. 61



Hydraulic Stretching Press of 300 Tons Capacity, Built by the Engineering and Research Corporation

Hydraulic Stretching Press of 300-Ton Capacity

Two hydraulic stretching presses, each of 300 tons capacity, have been built recently by the Engineering and Research Corporation, Riverdale, Md. The capacities of these presses are twice as great as those of similar types previously built by this company. The two presses are shown set up side by side in the illustration. They are designed to form sheet metal by restraining two edges of the sheets to be formed with clamps and forcing a wooden or metal die upward into the sheet material.

The inclinable table located between the two rows of clamps is operated by two cylinders having a maximum combined capacity of 300 tons. Each of the two motor-driven clamp supports is provided with six sheet clamps. The maximum length of the upward stroke of the forming member is 12 inches, and the maximum operating pressure on the piston is 3000 pounds per square inch. The maximum distance between the sheet-metal clamps is 80 inches, and the minimum distance 24 inches. 62

Lincoln "Fleetweld 10" Electrode

A new arc-welding electrode, developed to facilitate finishing operations on many welded products by eliminating the need for dressing or smoothing welded seams, has been brought out by the Lincoln Electric Co., 12818 Coit Road, Cleveland, Ohio. This electrode, known as "Fleetweld 10," is designed particularly for finish-bead U-groove welding operations in the downhand position. The electrode provides full slag coverage and gives a weld deposit of exceptional smoothness, the bead being uniform and regular without square shoulders. The metal smooths out evenly during welding and the line of fusion with the base metal is practically unnoticeable. This electrode can be used with either normal or reversed polarity and with direct current or alternating current. It is made in 1/4-inch and 5/16-inch sizes in 18-inch lengths. 63

To obtain additional information on equipment described on this page, see lower part of page 46.

Hydraulically Operated Brinell Testing Machine for Large Castings and Forgings

A Brinell testing machine for use on large and awkward-shaped castings, forgings, etc., has recently been placed on the market by the Detroit Testing Machine Co., 5137 Trumbull Ave., Detroit, Mich. This machine has a large stationary table and a ram of sufficient length to accommodate work in a wide range of sizes. The work is simply placed on the table, and the ram carrying the test ball is brought into contact with the surface to be tested.

Operation is controlled by a lever on the side of the machine. The ram can be stopped in any position, so that when several pieces of the same size are to be tested, the ram need be raised only high enough to permit removing and inserting the work. Movement of the lever rapidly adjusts the ram for work of different sizes. While the ram movement is rapid, the actual test is applied at a relatively low speed, thus avoiding impact errors. The operation is hydraulic throughout, a fractional-horsepower ball-bearing motor driving the operating pump, the shaft of which is ball-bearing mounted. All working parts operate in a bath of oil to insure long life.

Two standard sizes of these machines are available having throat depths of 6 and 9 inches and maximum heights of 12 and 18 inches. The table sizes are 12 by 20, and 17 by 24 inches. Special machines can be built to any dimensions. 64

Brinell Testing Machine Made by Detroit Testing Machine Co.

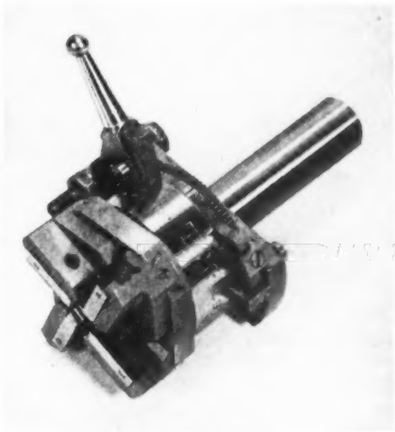


Fig. 1. J & L Model 16S Die-head with Hand Locking Lever

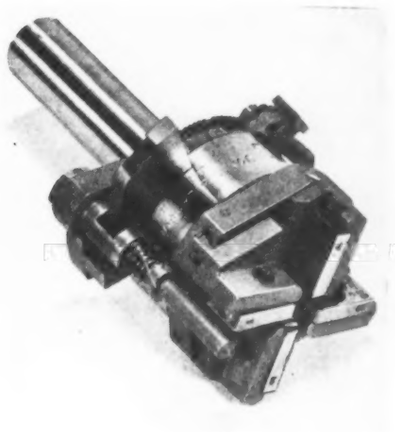


Fig. 2. J & L Model 16SB Die-head with External Trip

Jones & Lamson Die-Heads

The Jones & Lamson Machine Co., Springfield, Vt., has recently brought out two new die-heads, designated 16S and 16SB. The Model 16S die is designed for use on small hand screw machines. It is provided with an adjustable pull-off and a hand locking lever. The Model 16SB die has an external trip and is recommended for use on No. 0 and No. 00 Brown & Sharpe automatics. This die is so designed that it cannot open during the indexing movement on high-speed machines.

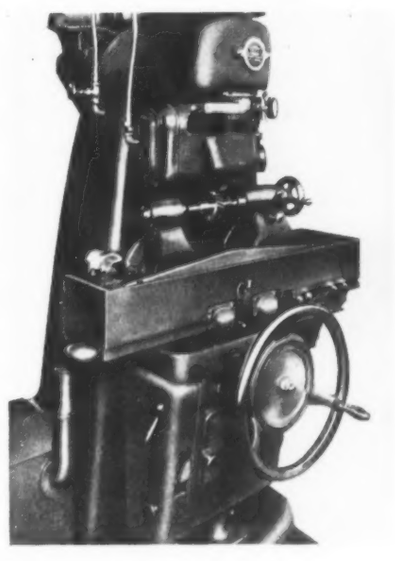
The two models are of the same general construction as the tangent dies of this company's manufacture, except for the chasers, which, although of the flat type, are equivalent in section to a tangent chaser. Both the top and bottom of the chasers are provided with chamfer and top rake. When the chasers become dull on the top surface, they can be turned over, thus doubling their life. The chasers are ground in the thread form after hardening. Each chaser is secured to the holder by a single screw which forces it against two ground surfaces. These chasers can be resharpened when dull. 65

"Red Ring" Gear-Shaving Machine Equipped for Crowning Gear Teeth

The "Red Ring" gear-tooth shaving machine developed by the National Broach & Machine Co., 11457 Shoemaker Ave., Detroit, Mich., can now be equipped with a special table for crowning gear teeth. Gear-tooth crowning, as here referred to, should not be confused with chamfering, which is merely a process affecting the ends of the teeth to facilitate sliding the gears into mesh. A crowned tooth is barrel-shaped, the chordal thickness of the tooth at the center or at some specified intermediate point being greater than the chordal thickness at either end, the difference usually being approximately 0.001 inch.

The gear-crowning equipment consists of a special table having a fulcrum in the center and actuated by an adjustable cam at the end. Maximum crown thickness can be produced at the center of the tooth or at any specified point between the ends by positioning the work in correct relation to the center of the table.

The amount of crown is determined by setting the controlling cam at the end of the table. When the



"Red Ring" Gear-shaving Machine for Crowning Gear Teeth

To obtain additional information on equipment described on this page, see lower part of page 46.

cam slot is in the parallel position, the machine generates conventionally shaped teeth—that is, teeth without any crown. Crowning does not consume any more machining time than conventional gear-tooth shaving. 66

Sterling Welders Equipped with Remote Control

The welding current on G-R welders made by the Sterling Products Co., 3380 Robertson Blvd., Los Angeles, Calif., can now be regulated without interrupting the work or even breaking the arc through the use of a remote control system. The new remote control developed by this company operates through a compact switch mounted on the welding tongs. A low-voltage relay circuit operated by the tong switch controls a reversible motor, which, in turn, operates the full-range stepless heat control. By thus giving the operator constant "finger-tip" control of the welding heat, interruptions of the work are avoided. The quality of the welding is also improved through this convenient means of providing the correct heat required for each type of welding rod or welding job.

Six of the seven models of transformer type welders manufactured by this company are now available with the new remote control system. The sizes range from the 20- to 125-ampere unit up to the heavy-duty industrial models which have a maximum output of 1250 amperes. The latter are designed for either single- or multi-circuit manual operation or as a source of current for automatic welding heads. 67

Sterling Welder Controlled by Switch Mounted on Welding Tongs

"Drive-All" Unit for Motorizing Machine Tools

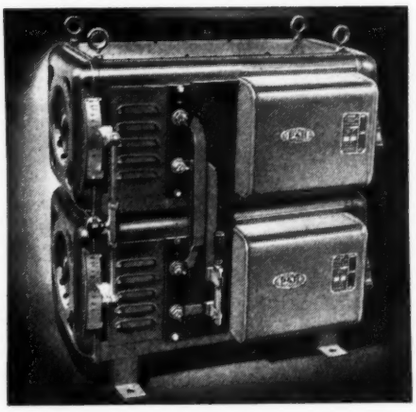
A "Drive-All" motorizing unit, which can be applied to all types of machine tools, power presses, and production machinery, has been brought out by the Drive-All Mfg. Co., 3408 Conner Ave., Detroit, Mich. With this drive, the operator can instantly obtain any one of three or four speeds by a simple movement of the speed-shifting lever. With a two-speed motor, six or eight speeds are available.

"Drive-All" Motorizing Unit for Driving Machines Requiring 1 to 5 H.P.

The built-in three- or four-speed transmission has sturdy gears, and the rotating parts are mounted in ball bearings to insure quiet, efficient operation. An oil bath provides adequate lubrication for the gears. The unit is built for driving machines requiring from 1 to 5 H.P. The motor rails can be adjusted to accommodate any size motor. The support and the motor rails are of rigid construction. Adjustments can be easily made to obtain the desired belt tension, and the belts can be provided with guards. 68

Welders Connected in Parallel for Increased Capacity

The Model WA-200 square-frame welder that the Harnischfeger Corporation, 4536 W. National Ave., Milwaukee, Wis., recently added to its line of P & H-Hansen electric arc welders can be readily hooked up in parallel, as shown in the illustration. These new square-frame welders (described in July MACHINERY, page 823) occupy only 3 1/2 square feet of floor space and provide a welding range of from 40 to 225 amperes. Where a wider range is desired for an occasional job, these welders can be mounted one above the other and hooked up in parallel. When two units are mounted in parallel, they provide two 225-ampere welding units which can be used separately, or one unit of 450-ampere capacity.



Two 225-ampere Welders Connected to Give 450-ampere Capacity

The welders can be used singly or in parallel, and can be connected or disconnected at will by means of a switch mounted on the lower unit. When used in parallel, the two units are controlled automatically in one operation by a "multiple shifter," also shown in the illustration. This shifter permits the operator to make the proper current setting for two, three, or more units simultaneously. 69

"Speedmaster" Hoist for All Industrial Applications

A new line of "Speedmaster" hoists for all industrial applications has been brought out by the Industrial Equipment Division of the Master Electric Co., Dayton, Ohio. As the name suggests, speed of operation is an outstanding feature of this line, which includes hoists having capacities of 250, 500, 1000, 2000, and 3000 pounds. These hoists are equipped with Master geared-head motors having sufficient power to insure continuous performance under exacting conditions.

An electric switch limits operation

To obtain additional information on equipment described on this page, see lower part of page 46.

"Speedmaster" Hoist Equipped with Switch to Prevent Over-running

in each direction and prevents over-running. The pistol-grip interlocked electric control is mounted on the lower end of a tube shown connected to the lower side of the hoist housing. A Master "Unibrake" stops the hoist quickly and holds the load. All models are equipped throughout with anti-friction bearings, and are available with rail, hook, or lug mounting. All sizes are of compact design, require small headroom, and can be used inside or out. Any desired length of lift can be provided, and a wide selection of capacities and speeds is available. 70

Oscillograph for Testing Vibration-Absorption Properties of Rubber

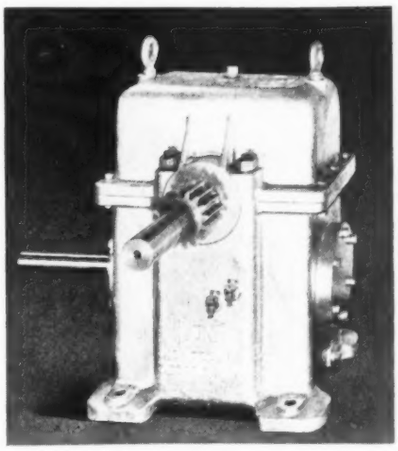
A new instrument designed for use in the laboratories of rubber manufacturing companies and for use by mechanical engineers in determining certain mechanical properties of rubber and rubber-like materials when used for vibration absorbers has been brought out by the American Instrument Co., 8010-8020 Georgia Ave., Silver Spring, Md. This instrument can be used to measure static characteristics under loading and unloading conditions; creep under a given dead load; and set as well as dynamic characteristics, including energy absorption during impact loading; resilience; and effective dynamic modulus.

The Oscillograph is complete in itself and provides an autographic record in a few minutes from which the various properties can be evaluated. The instrument can also be used as an auxiliary to a fatigue-testing machine to evaluate a test piece periodically throughout the duration of a life test. 71

"Cone" Worm-Gear Speed Reducers

A standard line of heavy-duty speed reducers in which "cone" type worm-gearing is incorporated, has been brought out by the Michigan Tool Co., 7171 E. McNichols Road, Detroit, Mich. The new units are roughly two-thirds the size and weight of former standard worm-gear reducers of similar capacities. The larger area per tooth and greater number of teeth in contact with the cone worm-gearing used in the new drives has made possible a reduction in center distances.

The high operating efficiency claimed for these units is attributed largely to the lubrication characteristics of the gearing. The worms

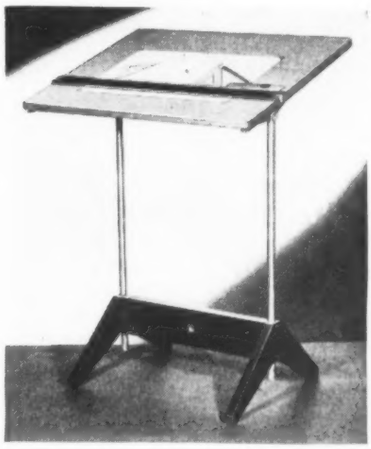


Michigan "Cone" Worm-gear Speed Reducer

are made of chromium-molybdenum-nickel steel having a tensile strength in excess of 150,000 pounds per square inch. Nickel bronze with a tensile strength of over 50,000 pounds per square inch is used for the worm-wheels. Anti-friction bearings are used throughout, except for the sleeve bearings on the gear-shaft in the larger units. Roller bearings are used in the gear-shafts in the smaller and intermediate sizes. The worm-shafts are carried in ball thrust and roller radial bearings in the larger units. The new models have center distances ranging from 3 to 15 1/2 inches. 72

"Esco" Drawing Stand

The Engineering Sales Co., 720 Clara Ave., Sheboygan, Wis., has just added a new drawing stand to its line of "Esco" drafting special-



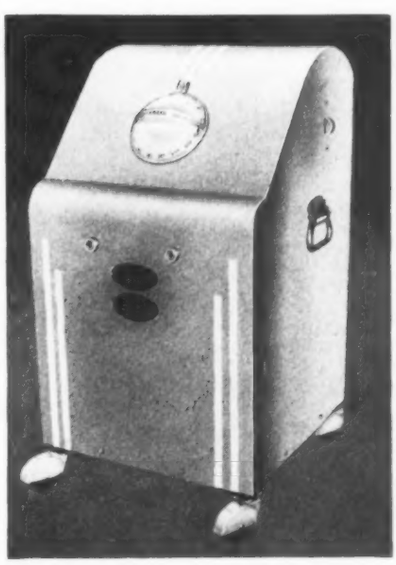
"Esco" Drawing Stand Made by the Engineering Sales Co.

ties. This drawing stand has been developed primarily to meet the demand for an efficient yet inexpensive small drawing unit for offices, drafting-rooms, and home use.

The complete unit is sturdily constructed and includes a drawing-board top, with straightedge and built-in parallel ruling device. It is available with drawing-board tops of three sizes—21 by 26 inches, 25 by 31 inches, and 25 by 37 inches—and is adjustable for height and inclination of the drawing surface. 73

Miller Alternating-Current Welders

The Miller Electric Mfg. Co., Appleton, Wis., has recently brought out an alternating-current line of



Miller Alternating-current Welder with Single Dial Control

To obtain additional information on equipment described on this page, see lower part of page 46.

welders of an entirely new design. The amperage, voltage, and reactance of these new welders are all controlled by one dial. The control dial is placed at an angle and at the correct height on the front of the cabinet to permit the operator to easily see the amperage markings and change the dial setting without moving from his working position. When set to the amperage desired, the voltage and reactance are changed automatically.

The welder holds its rated output, regardless of the temperature. It is built in four models, having capacities of 165, 200, 250, and 300 amperes. Each welder is completely equipped with 20 feet of welding leads, head shield, electrode-holder, clamp type ground, and an assortment of welding electrodes. 74

Danly Precision Die Sets

Danly Machine Specialties, Inc., 2112 S. 52nd Ave., Chicago, Ill., has brought out a new line of precision die sets in a wide range of sizes. This line includes regular, reverse, and long narrow types for any die from 3 by 3 inches up to 25 by 14 inches, and in many thickness combinations of die-holder and punch-holder. A new "square" series of back post sets is available for mounting square and round dies, which is made in a complete range of sizes from 3 by 3 inches to 14 by 14 inches.

These die sets are assembled with precision guide posts and bushings. The guide posts are hardened, ground, and lapped to limits of plus or minus 0.0001 inch. The bushings are of standard, shoulder, or extra long types and are ground and honed to the same accurate limits. All the die-holders and punch-holders of these sets which have the same dimensions are readily interchangeable. 75

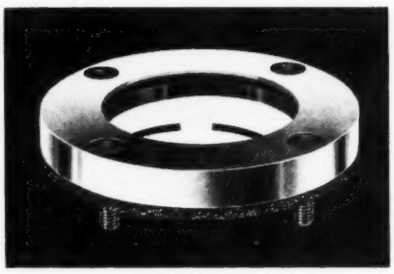
Knerr-King Portable Brinell Hardness Tester

A portable hydraulic instrument that makes the standard Brinell test with a gradually applied load of 3000 kilograms on a 10-millimeter ball is being introduced to the trade by Andrew King, 521 Broad Acres Road, Narberth, Pa. As the complete instrument weighs less than 26 pounds, it can be conveniently taken to work that would be difficult to transport to a stationary type of hardness testing machine. The instrument has a throat capacity of 4 inches deep by 10 inches high. Bars, rails, castings, tubes, and forgings can be tested in place. 76

Typical Application of the Knerr-King Portable Brinell Hardness Tester

Gits Gear-Case Oil-Gage Plugs

Two styles of brass oil-gage plugs of the glass-window type, which are especially adapted for use on transmission and gear-cases of all kinds, have been developed by the Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Ill.



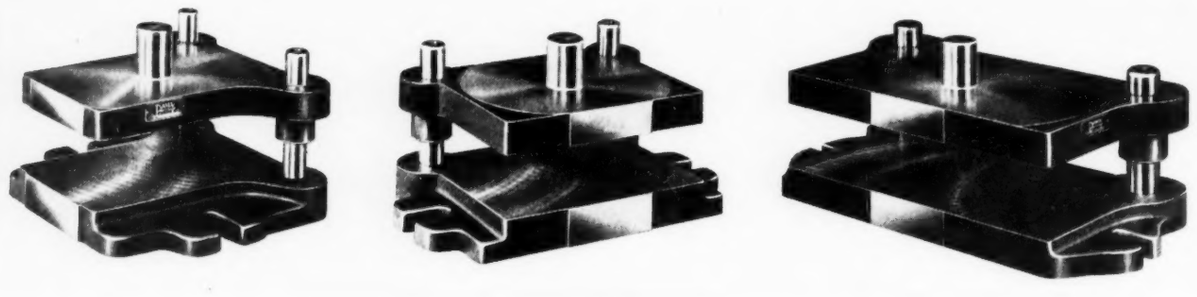
Gits Flanged Oil Gage for Flush Mounting

The Style BW Hex oil gages are turned from solid hexagonal brass rod and have die-cut shank threads. The glass disk is rolled between two heavy cork gaskets to insure leak-proof joints. The Style CW Flanged oil gage for flush mounting is turned from solid round brass rod. This style gage is provided with a white enamel background, which permits the oil level to be seen more clearly. All parts of this gage are replaceable. Four socket-head screws hold the unit firmly in place and guard against leakage of oil. These gages are made in sizes having sight holes ranging in size from 3/4 to 2 inches in diameter for the CW type, and from 15/32 to 2 inches for the BW type. 77

Stow Combination Flexible-Shaft Machine

A new Model AJ "combination" flexible-shaft machine consisting of a motor, flexible shaft, clamp spindle, and extension cord and plug has just been added to the "Junior" line of flexible-shaft units made by the Stow Mfg. Co., Inc., Binghamton, N. Y.

This new combination model is



Danly Precision Die Sets with Hardened Guide Posts and Bushings

To obtain additional information on equipment described on this page, see lower part of page 46.

Stow Combination Flexible-shaft Machine

intended for both bench and portable use, being fitted with a conventional base and also with a carrying handle. Its compactness and light weight permit it to be operated in close quarters for grinding, light drilling, filing, polishing, and sanding operations.

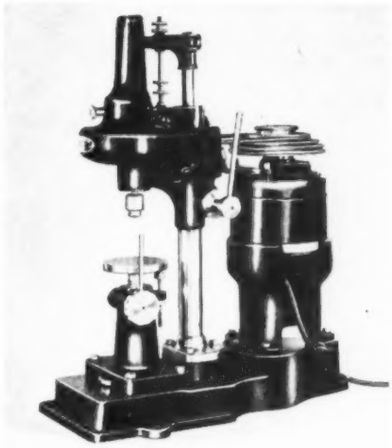
The same attachments furnished for the heavy-duty machines of this company's manufacture can be employed on the combination model. The machine is made in 1/4-, 1/3-, and 1/2-H.P. sizes, with speeds from 1750 to 3400 R.P.M. 78

Hydraulically Controlled Contour Duplicating Attachment

A hydraulically controlled contour duplicating attachment for lathes, grinders, milling machines, etc., has been added to the line of equipment made by the Duplicating Attachment Co., 2130 Salina St., Dearborn, Mich. With this attachment combinations of taper, step and contour turning, and boring and facing operations can be readily performed.

The attachment is entirely separate from the lathe when the hydraulic control is not in use. In order to engage the hydraulic control it is only necessary to adjust one screw. Contours can be duplicated either from a thin templet or a finished piece of work.

Two controls are located at the bottom of the lathe carriage. One control is employed for adjusting the speed or stopping the in-and-out movement of the cross-feed, while the other control is used for moving the tool away from the work when desired. An adjustable automatic depth stop is used when the work is being roughed out. 79



"High Speed" Drilling Machine with Sensitive Table Feed

"High Speed" Super-Sensitive Drilling Machine

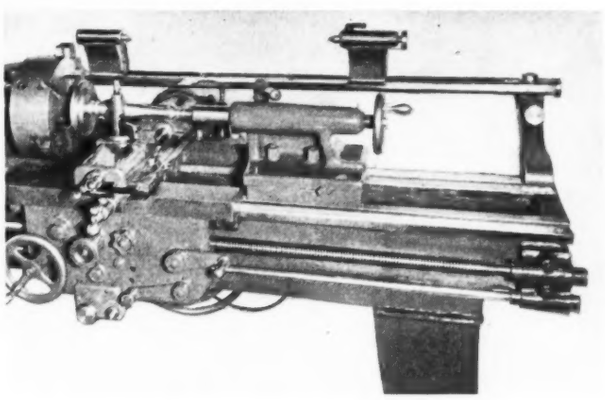
The High Speed Hammer Co., Inc., 333 Norton St., Rochester, N. Y., has added a new unit to its R-53 line, which has a capacity for drilling holes from 0.004 to 1/4 inch in diameter. When drilling holes that are smaller than No. 80, or 0.0135 inch in diameter, which requires a machine of extreme sensitivity and precision, the super-sensitive table of the new unit is used. For this work the drilling machine spindle is locked in a fixed position and the work and table are fed upward to the drill under a spring tension that is adjustable to suit the work.

When using drills from No. 60 up to 1/4 inch in diameter, the table is locked in any desired position, and the spindle is operated in the conventional manner. The standard spindle speeds are 750, 1500, 3000, and 6000 R.P.M. 80

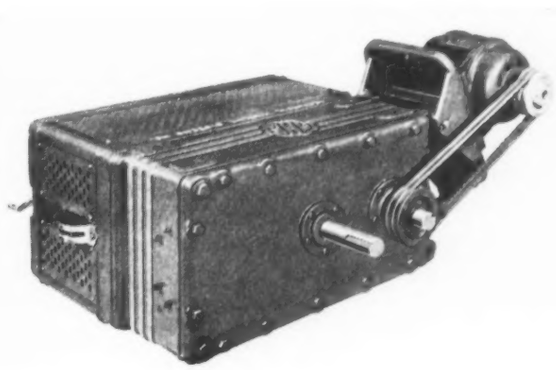
High-Capacity Variable-Speed Drive Unit

A new type of variable-speed drive unit has been placed on the market by Mechanical Handling Systems, Inc., 4700 Nancy Ave., Detroit, Mich. This unit is made in capacities for delivering up to 80,000 pounds torque and for providing infinitely variable speed changes from 310 R.P.M. forward to 9 R.P.M. in the reverse direction with any standard 1 to 10 H.P. motor.

A wide range of speeds, variable to a fraction of 1 R.P.M. by turning a control handle mounted on the side of the drive unit case, is obtained by the use of a standard variable-speed transmission driven by the motor, which in turn drives a conventional speed reduction gear. This gearing increases the available speed range and permits reversing the direction of rotation, or even stopping rotation, of the output shaft without interfering with the operation of the driving motor. A speed indicator is mounted on the outside of the case near the speed control handle which can be locked against



Lathe Equipped with Contour Duplicating Equipment



Variable-speed Drive Unit Made by Mechanical Handling Systems, Inc.

To obtain additional information on equipment described on this page, see lower part of page 46.

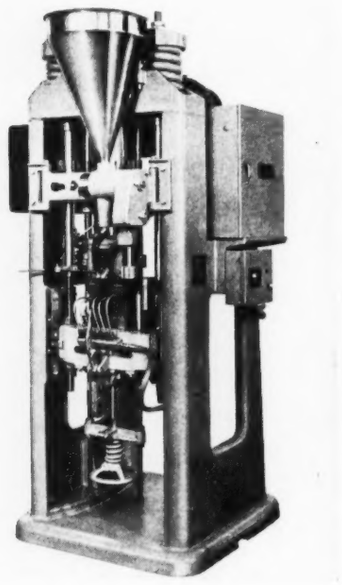
unauthorized adjustment. Remote control by either mechanical or electrical means is available, as well as a control for synchronizing speeds of two or more units. 81

Stokes Automatic Plastics Molding Machine

The F. J. Stokes Machine Co., Olney P. O., Philadelphia, Pa., has recently added to its line of completely automatic plastics molding machines a larger machine of 15 tons capacity with a 10-inch stroke. Although the rated capacity is 15 tons, this machine will produce moldings requiring up to 18 tons pressure, and will mold parts up to 4 inches high by 6 inches long, with a projected area of 19 square inches. An important feature of this machine is an adjustable bolster for reducing the length of the ram travel to increase the production rate on shallow work.

Single-cavity molds are used on the machine, which can be operated continuously. The output from one single-cavity mold ranges up to 10,000 or more pieces per week. When two or more molds are used in the same machine, the production is, of course, proportionately greater. Like the earlier models, this machine is fully automatic, self-contained, and electrically heated and powered. It stops automatically, and sounds a signal if a molding fails to be ejected or the material hopper is empty.

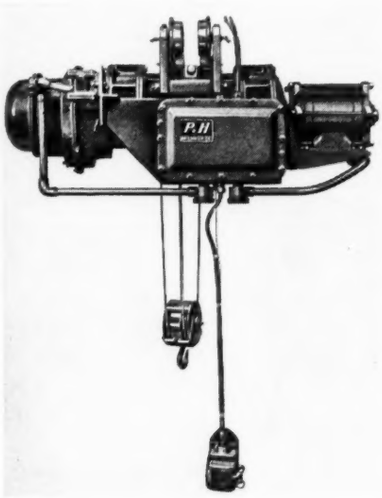
The machine can be quickly set up or changed over from one job to another, and can be operated efficiently on short runs. It requires no manual operating attention, and handles all free-flowing thermo-setting materials. 82



Stokes Automatic Plastics Molding Machine with a Capacity of 15 Tons

P & H Hoist with Explosion-Proof Electrical Equipment

The Harnischfeger Corporation, 4536 W. National Ave., Milwaukee, Wis., has recently added explosion-proof electrical equipment for hoists to its P & H line. This equipment has been developed to eliminate the hazardous sparking of electric hoists which has previously restricted their use in certain types of plants. Explosion-proof motors and explosion-proof reversing starters, together with geared upper and lower limit switches and push-button stations, are employed on these hoists.

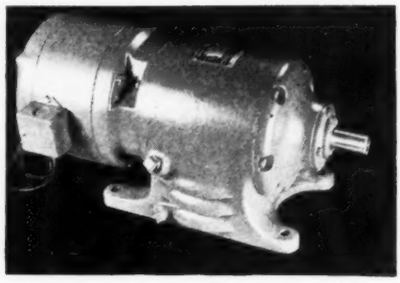


P&H Hevi-Lift Hoist with Explosion-proof Electrical Equipment

All this equipment bears the underwriter's approval for Class 1, Group D hazardous location service. The wiring is in a rigid conduit with explosion-proof fittings, and the electric brake is enclosed in a heavy cast-iron cover which is bolted to the gear-case cover. To further reduce the possibility of sparking, a flexible cable connection is used, together with spark-proof trolley wheels. 83

Boston Gear Straight-in-Line "Ratiomotor"

The Boston Gear Works, Inc., North Quincy, Mass., has recently developed a new straight-in-line "Ratiomotor," designated as Type SME. This is a complete motorized reduction unit of the straight-in-line design, and is the latest addition to the company's regular "Ratiomotor" speed reducers and motorized units. It is available in five output speeds, with either a 1/2- or a 3/4-H.P. motor. 84

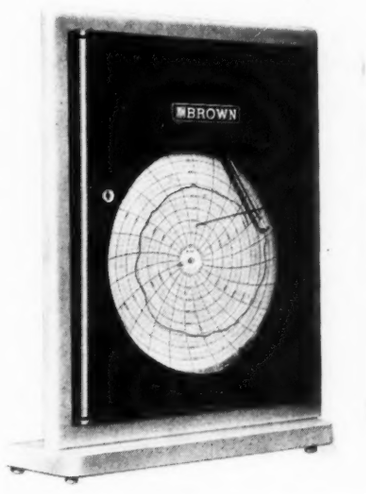


"Ratiomotor" Available in Five Output Speeds

Brown Thermometer and Pressure and Vacuum Gages

A new line of temperature and pressure recorders, indicators, and controllers has just been placed on the market by the Brown Instrument Co., Wayne and Roberts Aves., Philadelphia, Pa. This line includes thermometers of the indicating and recording types for temperatures from minus 40 degrees F. up to 1200 degrees F.; indicating or recording pressure and vacuum gages for ranges from 6 to 2500 pounds per square inch, and vacuum ranges of 10 inches of mercury and over. All types are offered in one-, two-, and three-pen models.

A special safety link between the



Brown Indicating and Recording Instrument

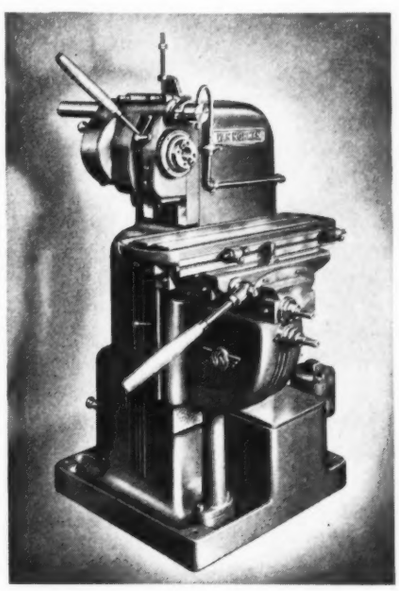
To obtain additional information on equipment described on this page, see lower part of page 46.

actuating element and pen provides an overload safeguard which protects the mechanism from damage if the pen is accidentally or intentionally moved in either direction. The recording chart is firmly secured to the driving mechanism by a tapered stud. Another tapered stud insures accurate positioning of the chart. A friction clutch permits the chart to be rotated manually in case resetting to the correct time is necessary because of current failure. 85

Van Norman Hand Milling Machine

A precision-built heavy type hand milling machine, designated as No. 6, has been brought out by the Van Norman Machine Tool Co., Springfield, Mass., which is adapted for the rapid handling of many small jobs found in production departments. The rigidity required for a high metal-removing capacity is assured by large hand-scraped surfaces and slides that have adjustable tapered gibs and locking binders.

Any one of six spindle speeds ranging from 160 to 1100 R.P.M. can be readily selected. The rack-and-pinion table feed is hand controlled from either the front or back of the machine. Table stops are provided with micrometer attachments. The vertical cutter-head movement has a new positive control. Equalized belt tension on the heavy-duty cutter-spindle is maintained regardless of the cutter-head position. The table work surface is 26 by 6 inches. ... 86



Van Norman Heavy Type Hand Milling Machine

Simplex Vises for Welding and Production Operations

The Desmond-Stephan Mfg. Co., Urbana, Ohio, has recently brought out two new Simplex vises. One vise, designated as the "Welders," has a double swivel arrangement as shown in the accompanying illustration, which enables the work to be held in the best position for fast, accurate welding. This vise can be changed into a regular swivel base machinist's vise in a moment's time. It is made in three sizes having jaw openings of 5, 6, and 7 inches and

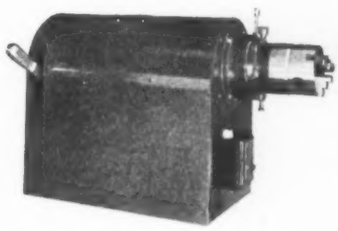
Simplex Welders' Vise Brought out by the Desmond-Stephan Mfg. Co.

weights of 47, 62, and 74 pounds, respectively.

The other vise, designed to save time on filing, fitting, or assembly work, is designated as the "Production" vise. Raising or lowering the vise handle, which is located on the right-hand side, instantly opens or closes the vise jaws. A considerable saving in time on production or repetitive operations is obtained as a result of this simplified clamping arrangement. This vise is made in both stationary and swivel base types with jaw openings of 3 1/2, 4 1/2, and 5 1/2 inches. 87

"Ideal" Variable-Speed Lathe for Bench Mounting

The Schauer Machine Co., 2060-68 Reading Road, Cincinnati, Ohio, has recently brought out a new type of variable-speed lathe that is adapted for use in production work on parts requiring grinding, lapping, filing, and polishing operations. This lathe



"Ideal" Variable-speed Lathe Built for Bench Mounting

is built for bench mounting and has an over-all length of approximately 26 1/2 inches, a width of 11 1/8 inches, and a height of 16 3/16 inches. It occupies a bench space 11 by 18 inches, is totally enclosed, and is equipped with a removable motor of standard NEMA frame size. Any spindle speed from 75 to 6350 R.P.M. can be obtained, the range of variation being approximately 6.8 to 1 with a single-speed motor, and 14 to 1 with a two-speed motor.

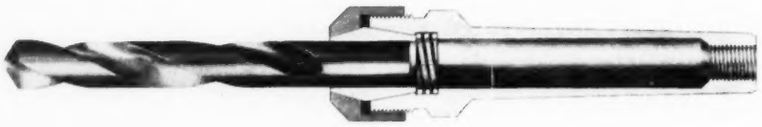
Any spindle speed within the range of the machine can be obtained by the simple movement of a hand lever, it being unnecessary to stop the lathe spindle when changing from one speed to another. 88

Portable Acetylene Generator

A new medium-pressure acetylene generator, known as the "Oxweld MP-9," designed to combine port-

Portable Acetylene Generator Made by The Linde Air Products Co.

To obtain additional information on equipment described on this page, see lower part of page 46.



Collet Chuck with Release Spring, Made by Universal Engineering Co.

ability with the operating advantages usually found only in larger units, has just been brought out by The Linde Air Products Co., 205 E. 42nd St., New York. This generator weighs only 129 pounds, holds 25 pounds of size 14ND Union carbide and will deliver as much as 50 cubic feet of acetylene per hour at any desired pressure up to 15 pounds per square inch. Several hours of continuous welding or cutting on all except the heaviest work can be obtained from one charging, a smooth flow of clean, dry acetylene being obtainable with no appreciable variations in pressure.

The generator is simple to operate, only one handle being used to start or stop the generation of acetylene and to adjust the pressure. After starting, the generator is fully automatic in operation. 89

Whistler Universal Perforating Dies

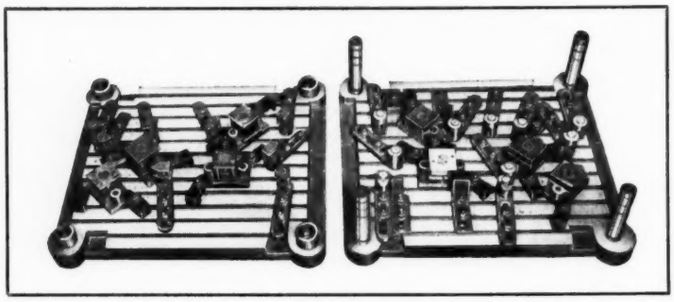
A line of universal perforating die units which can be quickly assembled to provide an efficient die for practically any type of perforating or notching operation on flat sheets up to 1/8-inch in thickness, has been brought out by S. B. Whistler & Sons, Inc., 742 Military Road, Buffalo, N. Y. The dies made up from these units can be used on any type of press. They are especially adapted for small-lot duplicate stamping work. In the accompanying illustration is shown a typical perforating die produced by simply assembling the universal dies units required for a particular job. This method of construction not only reduces the die cost, but permits changes in the die lay-out to be made quickly without incurring additional expense for die equipment. 90

Universal Collet Chucks Equipped with Release Spring

The collet chucks made by the Universal Engineering Co., Frankenmuth, Mich., improved models of which were described on page 730 of June MACHINERY, have been improved still further by the addition of an automatic release spring. The jaw releasing spring, positioned as shown in the accompanying illustration, serves to force the collet jaws forward so that they spring open, thus automatically releasing the grip on the tool when the nut is turned in the opening direction. 91

New Chaser-Holders for J&L Tangent Die-Head

In order to increase the capacity of the Model 22 tangent die-head made by the Jones & Lamson Machine Co., Springfield, Vt., and to adapt it for wider fields of application on hand screw machines and turret lathes, this company has brought out chaser-holders of a new design. These holders are especially adapted for use where frequent changes in the work are necessary and where a wide range of thread sizes must be accommodated. Chaser-holders of 1/4 to 3/4 inch capacity, which take the standard Model 21 die chasers, can now be furnished for the Model 22 die, as well as chaser-holders of 3/4 inch to 1 1/4 inches capacity. An additional set of chaser-holders having a capacity of 1 1/8 to 1 1/2 inches is available for this die. Each set of holders will accommodate any diameter and pitch thread within the capacity of the die. 92



Perforating Die Assembled from Units Made by S. B. Whistler & Sons, Inc.

Small Size Portable Pneumatic Grinder

A portable pneumatic grinder designated as the Thor "Bantam," which is 5 1/2 inches long and weighs only 18 ounces, has just been brought out by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. The spindle of this grinder operates at a free speed of 14,000 R.P.M. Mounted abrasive wheels of all shapes and sizes from the smallest pointed wheel up to round wheels 1 1/2 inches in diameter can be used. Other accessories, such as rotary files and steel cutters, sanding disks, wire brushes, saw blades, and buffing and polishing wheels, can also be used with this tool.

Thor "Bantam" Pneumatic Grinder Equipped with Abrasive Wheel

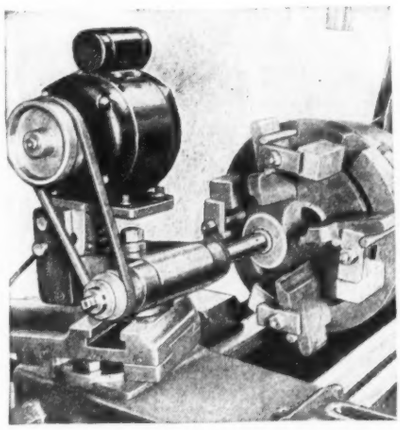
One of the advantages of this air-operated tool is its ability to maintain a nearly constant speed under load with a low air consumption. Standard equipment includes a push-button throttle that can be locked to obtain continuous operation, a 1/4-inch collet, and a swivel hose connection. A lever throttle can be supplied

To obtain additional information on equipment described on this page, see lower part of page 46.

in place of the push-button throttle if desired, and the adapter for a collet can be replaced by an adapter equipped with a chuck. 93

"All Purpose" Toolpost Grinder

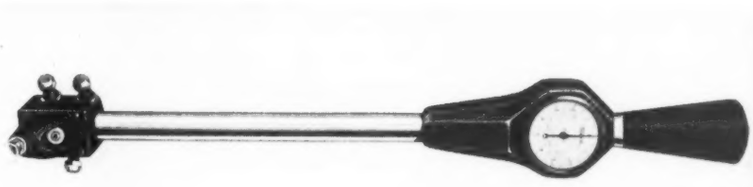
A toolpost grinder, designated the "All Purpose" to indicate its wide range of application on lathes, milling machines, shapers, planers, etc., and various classes of bench work, is being manufactured by the R. G. Smith Tool & Mfg. Co., 245 South St., Newark, N. J. The illustration



"All Purpose" Grinder Set Up for Finishing Internal Threads

shows the attachment employed in grinding internal threads, which are finished to extremely accurate limits. A spherical radius adapter mounting enables the operator to adjust the grinder accurately and quickly to the center of the work. This arrangement also makes it possible to adjust the attachment to any position in any plane and at any angle.

Other features include an automatic belt tension adjustment; eight speeds obtainable by interchanging pulley and sheave; means for taking up wear without disassembling; spindle that accommodates standard surface grinder wheels in either standard or special thicknesses; provision for replacing wheel on drive end of spindle for certain jobs; large tapered sleeve bearing at grinder end of spindle and ball bearing at drive end; dynamically balanced motor; vibration absorbing spring; and enclosed bearings. 94



Federal Direct-reading Bore Gage

Federal Self-Locating Cylinder or Bore Gage

A gage for checking the bores of automobile cylinders and other work requiring high accuracy has been brought out by the Federal Products Corporation, 1144 Eddy St., Providence, R. I. This gage is designed to check bores for diameter and out-of-roundness. It is a positive self-locating direct-reading type, having two-point contact and three fixed locating points which position the two measuring points diametrically and perpendicularly with respect to the cylinder. Accurate centralization of the gage is assured for any diameter throughout its range. Two of the three locating points position the diameter-measuring points at right angles to the cylinder walls, while the third provides for accurate positioning on the cylinder surface. The motion of the sensitive contact is transmitted to the indicator directly through a rod suspended by a flat spring and a bellows spring.

This gage is made in two sizes, the 12 P-3 size having a range of adjustment from 2 7/8 to 5 inches in diameter, and the 12 P-4 type for diameters from 5 to 10 inches. The standard length of the gage from the contact points to the lower end of the grip is 10 inches. The standard C-21 indicator employed is graduated to 0.0001 inch and has a reading range of plus or minus 0.005 inch. 95

"Wonder Weld" Heat-Resisting Compound

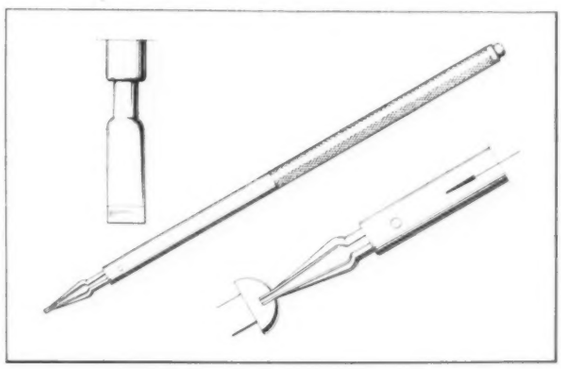
A patented heat-resisting compound capable of concentrating heat at any spot to be welded by the acetylene torch is being made by the Miller Mfg. Co., Camden, N. J. This compound has been developed especially to meet the needs of welders using the acetylene torch for welding parts near glass, rubber, wood, upholstery, paint, etc. The compound is harmless to fabric or skin and has successfully withstood direct heat at temperatures up to 7000 degrees F.

The compound is simple to use, is not gaseous, and can be readily mixed with clean water to form a paste that is spread over the material to be protected. The mixture is applied to a depth of 1/2 to 3/4 inch. When the job is finished, the compound can be scraped off or washed off with clean water and stored away until needed again for another job. 96

Screw-Holding Driver

The H. J. J. Co., 1924 Franklin St., Oakland, Calif., has brought out a new screw-holding screwdriver of the expanding bit type. This screwdriver has been developed to meet the demand for a tool that will facilitate both the insertion and the removal of screws, especially screws that are located in places where it is difficult to use an ordinary screwdriver efficiently.

A screw is merely placed in position on the end of the driver and pushed back with a light pressure. This causes the two members that comprise the bit to



Screw-holding Screwdriver Made by the H. J. J. Co. for Use in Inaccessible Places

To obtain additional information on equipment described on this page, see lower part of page 46.

recede into the body of the driver and at the same time to expand in the screw slot, so that the screw is held securely. The screw can be quickly released by pressing the end of the rod which projects beyond the end of the knurled handle.

The tool is now available in sizes and lengths adapted for both production and service in electrical, radio, automotive, and office equipment industries. 97

Rotor "Power-Plus" Grinders

The Rotor Tool Co., 17325 Euclid Ave., Cleveland, Ohio, has just added two new "Power-Plus" grinders to its line of pneumatic tools. These right-angle head grinders have vertical spindles and are designed to have the smallest possible clearance for height and side-to-center distances, so that they can be used in places ordinarily inaccessible to portable tools. They are adapted for grinding metal with cup-wheels, for sanding with pads, or for wire brushing with cup-shaped brushes.

Magnesium alloy is used in the construction of these grinders to reduce the weight and to give them a good balance. The M-818 grinder, shown in Fig. 1, weighs 9 pounds and runs free at a speed of 7500 R.P.M. when using 4-inch elastic cup grinding wheels, and at 6000 R.P.M. when using 5-inch elastic cup grinding wheels and 7-inch sanding pads. The M-819 grinder, shown in Fig. 2, weighs 11 pounds and runs at 5000 R.P.M. when using 6-inch elastic cup-wheels, 9-inch pads, or 4-inch brushes. When using 6-inch cup brushes, the speed is 3500 R.P.M. Speeds of 3100 and 2480 R.P.M. are also available. 98

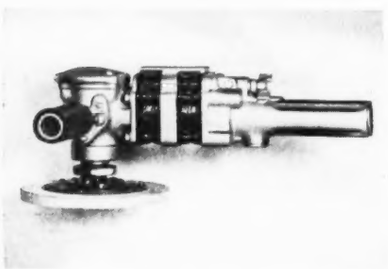


Fig. 1. Right-angle "Power-Plus" Grinder with 7-inch Sanding Pad

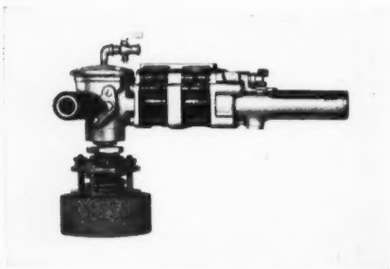
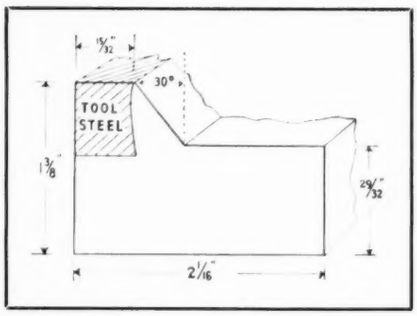


Fig. 2. "Power-Plus" Grinder Equipped with 5- by 2-inch Wheel



New Die Section Added to the Jessop Line of Rolled Shapes

Jessop Rolled Composite Die-Section Shapes

A new die section, designated Section D, has just been added to the line of rolled composite die-section shapes made by the Jessop Steel Co., 605 Green St., Washington, Pa. Section D, of the dimensions shown in the accompanying illustration, was developed for making small dies such as are used in the manufacture of toys, refrigerators, containers, and other articles where composite die sections of smaller size than those previously available are needed. The new section weighs 7.25 pounds per linear foot.

The sections consist of a tool-steel cutting edge backed by non-hardenable soft steel. One of the principal advantages of these sections is that they can be hardened before drilling dowel-holes, thus eliminating expensive lapping operations and assuring a good fit of the sections on the holder. Any slight warpage which takes place during heat-treatment of the composite section can also be readily corrected on a pusher type straightening machine. The composite sections may be formed either hot or cold to special shapes without harming the weld. 99

* * *

There is no greater obstacle to success in the solution of an engineering problem than the tacit assumption that the problem cannot be solved at all.

Spider Webs in Industry

Probably most mechanics do not realize that the so-called "cross-hairs" in the eye-piece end of transits and levels are actually strands of spider-spun cobwebs. Finely drawn platinum wire is sometimes used, but is not fine enough for the best instruments. Even the ordinary house spider cobwebs, while fine, are said not to be thin enough; hence, firms making high-grade transits and levels, like the Keuffel & Esser Co., from whom this information was obtained, actually capture hundreds of the right kind of spiders for the purpose of obtaining cross-hairs for instrument eye-pieces. As the spider spins, the thread is wound somewhat like a silk thread would be. While in captivity, the spiders will not eat and are usually released after one spinning. New batches are obtained from a squad of boys who capture most of them in meadowland country sections.

* * *

Vocational Course to Train Aircraft Assembly Workers

In cooperation with the Glenn L. Martin Co., Baltimore, Md., the Baltimore school authorities have established a course to train high school graduates in the fundamentals of machine shop practice, particularly as they relate to the making and assembly of aircraft parts. Sixty young men began an intensive twelve-week training course at the vocational high school in Baltimore early in July under the guidance of two instructors appointed by the school board and one from the Glenn L. Martin organization. The classes are maintained on a five-day, eight-hour schedule, the students punching a time clock as in regular factory practice. Tools and materials are lent by the aircraft company, but the work produced at the school will not be used in regular airplane construction.

* * *

The great inventions and improvements of the last one hundred and fifty years have been the work of scientists, inventors, engineers and mechanics of all kinds, working free and untrammeled by restrictive influence of any kind, save their own regard for accuracy and truth.—*Dexter S. Kimball, formerly Dean of Engineering at Cornell University.*

To obtain additional information on equipment described on this page, see lower part of page 46.

NEWS OF THE INDUSTRY

Illinois, Indiana, and Iowa

LINK-BELT CO., 307 N. Michigan Ave., Chicago, Ill., has organized the LINK-BELT SPEEDER CORPORATION, with headquarters at 301 W. Pershing Road, Chicago, Ill., for the manufacture and sale of excavating and material-handling shovels, draglines, and cranes, including a full line of track type locomotive cranes.

INLAND STEEL CO., 38 S. Dearborn St., Chicago, Ill., has issued licenses for the manufacture of Ledloy to the HEPPENSTALL CO., of Pittsburgh, Pa., and to the AMERICAN ROLLING MILL CO. of Middleton, Ohio.

HENRY R. deHOLL has retired as general superintendent of the Indiana Harbor Works of the Inland Steel Co., Chicago, Ill., after twenty-six years of service and will be succeeded by FREDERICK M. GILLIES, formerly assistant general superintendent. Mr. deHoll will retain his connection with the company in a consulting capacity. A testimonial dinner was tendered to him by about eighty of his friends and associates before he left.

EARL B. CUTTER, for thirty-four years a salesman in the Middle West for the Norton Co., Worcester, Mass., retired on August 1, and plans to spend his time in the future on his farm in Michigan. For many years Mr. Cutter has had his headquarters in Davenport, Iowa. EARL C. WILLEY, of the Chicago office, has been transferred to Davenport to take Mr. Cutter's place.

Michigan and Wisconsin

FIRTH-STERLING STEEL CO., McKeesport, Pa., announces the election of officers of the American Carbide Alloys Corporation, a newly acquired subsidiary of the company: President, L. GERALD FIRTH; first vice-president, G. A. JACOBS; second vice-president, W. H. LOLLEY; treasurer, CLYDE N. GILLESPIE; and secretary, H. R. HUEMME. GEORGE KNAEPPER has been appointed chief engineer of the company. The main office and works of the new company will be located in Detroit, Mich.

ATLAS PRESS CO., Kalamazoo, Mich., manufacturer of lathes, shapers, drill presses, and arbor presses, has recently erected an addition to its plant which will provide an increased working area of 17,000 square feet. A similar addition was completed about two years ago.

WILLIAM C. VAN CLEAF has been appointed director of industrial relations of the manufacturing departments of the Allis-Chalmers Mfg. Co. at the main works in Milwaukee, Wis.

New Jersey and Pennsylvania

JED S. FOSTER, vice-president and chief engineer of the Lidgerwood Mfg. Co., Elizabeth, N. J., recently completed fifty years of active service with the company. To commemorate the occasion, a testimonial dinner was given Mr. Foster by his associates, at the Winfield Scott Hotel in Elizabeth.

WILLIAM H. DUNN, comptroller and assistant treasurer of Raybestos-Manhattan, Inc., Passaic, N. J., was elected secretary of the corporation at a recent meeting of the board of directors, succeeding the late Morton F. Judd.

METALLIZING CO. OF AMERICA, INC., 562 W. Washington Blvd., Chicago, Ill., has recently opened a sales and service office at 602 Academy Bldg., 17 Academy St., Newark, N. J., with WILLIAM McMAKIN in charge.

ROBERT N. YATES, for a number of years a member of the sales department of the Erie Foundry Co., Erie, Pa., has been made assistant sales manager of the company.

New York and New England

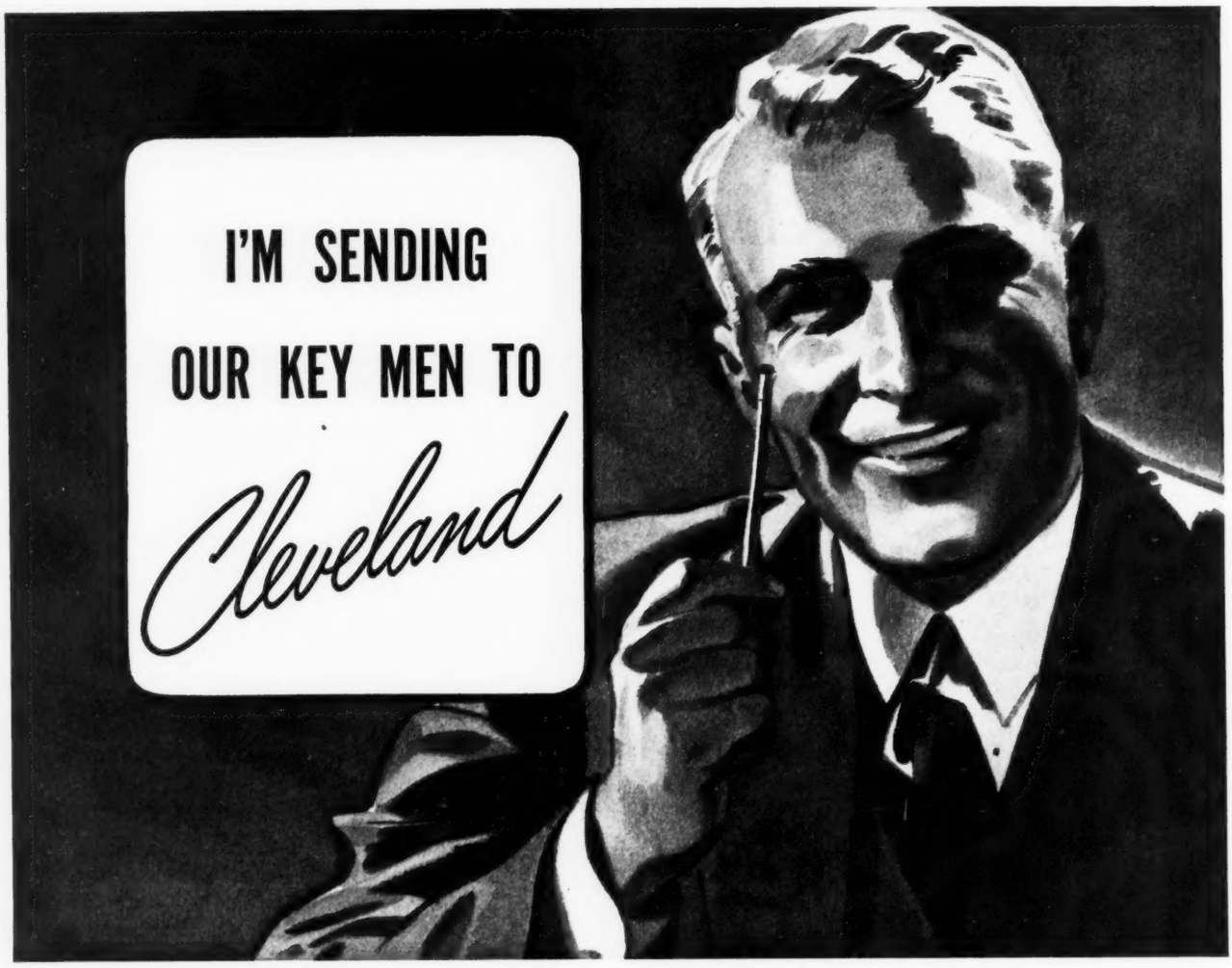
VLADIMIR KARAPETOFF, professor of electrical engineering in the College of Engineering, Cornell University, Ithaca, N. Y., retired in June and has been made professor emeritus. Professor Karapetoff joined the faculty in 1904 as assistant professor of electrical engineering and became professor in 1908. He was born in Petrograd, Russia, in 1876 and received the degrees of CE and MME at the Imperial Institute of Ways of Communication. He came to America in 1902 and was first connected with the Westinghouse Electric & Mfg. Co., later serving as consultant in engineering to the General Electric Co., many engineering firms and utilities, and the United States Government. He is a prolific inventor of electrical devices and musical instruments, a musician, poet, and composer, and in addition, holds a commission as lieutenant commander in the United States Naval Reserve Force. He has also written many technical books and articles. Professor Karapetoff will continue to act as a technical consultant for the University.

R. HOE & CO., INC., with plants at 138th St. and East River, New York City, and Dunellen, N. J., who, for more than one hundred years, have been identified almost exclusively with the design and manufacture of large newspaper and magazine printing presses, have announced the formation of a new Industrial Division for diversifying the company's products. The first work scheduled for the new division includes housings, crankcases, brake-drums, and jigs and fixtures for the aviation industry, and recoil mechanisms for anti-aircraft gun mounts.

H. L. SCHERMERHORN and J. H. O'BRIEN have joined the roll of "fifty-year men" of the General Electric Co., Schenectady, N Y. This makes a total of six General Electric employes who have been connected with the company for fifty years or more. Mr. Schermerhorn has the distinction of being the first G.E. man who has a son within the ranks belonging to the "twenty-five-year organization." There are seven thousand members in the General Electric "Quarter-Century Club."

S. H. REYNOLDS was recently appointed manager of stainless steel sales of the Crucible Steel Co. of America, with headquarters in the executive offices, Chrysler Bldg., New York City. Mr. Reynolds was previously manager of the Atlanta branch of the company; M. J. McKEEVER has been made acting manager of the Atlanta branch. The appointment of J. P. LARKIN as manager

S. H. Reynolds, Manager of Stainless Steel Sales of the Crucible Steel Co. of America



"When the last Machine Tool Show was held in 1935, I let one of our men go over. I thought he could look around and bring back all the information we would be interested in having. The first day of the show he called me up long distance. Told me I must come over the next day and bring three department heads with me.

"Well, I went over that night, and the next day I was on the long distance phone, but instead of three men I had six come. It was one of the best things we ever did. We had the combined judgment of our principal key men in regard to the new developments and what we should do to profit by them.

"There will be twice as many of us this time. With the show lasting for ten days, we can have our key men stay long enough to do the thing right. And this year I'm going to get a couple of our directors over to the show if I have to 'shanghai' them to do it."

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OCTOBER 4-13, 1939
NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION
10525 CARNEGIE AVENUE, CLEVELAND, OHIO

of the magnet department, with headquarters in New York, was also announced.

OAKITE PRODUCTS, INC., 22 Thames St., New York City, announces the addition of the following men to its sales and service organization: H. LOVE covering southwestern Pennsylvania; CHARLES E. HUGHES, Vermont and New Hampshire; B. O. KENDALL, western section of Los Angeles; R. L. FAIRCHILD, western portion of Cleveland; W. C. THIESS, western Detroit; JOHN MACKESY, San Jose, Calif., and adjacent counties; E. M. JAHRAUS, Portland, Ore.

NEWTON S. HOERLE has been appointed factory manager of the Easy Washing Machine Corporation, Syracuse, N. Y. Mr. Hoerle formerly held the position of chief engineer of the Muskegon plant of the Continental Motors Corporation, and just prior to his present appointment was production engineer of the Carrier Corporation.

ROME MACHINERY SALES AND ENGINEERING CO., 627 Webster St., Rome, N. Y., has been established to design and manufacture a complete line of polishing and buffing machinery and allied equipment. NORMAN CHESTER, for twenty-three years with a well-known metal-finishing equipment manufacturer, will assume the management of the newly established concern.

WALTER P. CAHILL, general superintendent and a member of the board of directors of the Graton & Knight Co., Worcester, Mass., has resigned, after about twenty years' connection with the company.

Ohio

PAUL F. ZERKLE, formerly Ohio district manager of the Midwest Tool Co. and the McCrosky Tool Corporation, has been appointed vice-president in charge of sales of the National Tool Co., Cleveland, Ohio. Mr. Zerkle was one of the charter members of the American Society of Tool Engineers and is a past-president of the Cleveland Chapter of the Society.

PAUL S. MENOUGH, formerly with the Duraloy Co., Michigan Steel Casting Co., and Michiana Products Co., has been made chief engineer of the Standard Alloy Co., Cleveland, Ohio. FRANK P. MORROW, Detroit district manager of the company, has been made sales manager.

PHOENIX MACHINE CO., 2701 Church Ave., Cleveland, Ohio, has appointed DOWDING & DOLL, LTD., Greycoat St., Westminister, London, England, European distributor for the Lester die-casting and plastic injection molding machines.

John E. Snowberger, New Works Manager of the Willys-Overland Motors, Inc.

JOHN E. SNOWBERGER was recently appointed works manager of the Willys-Overland Motors, Inc., Toledo, Ohio. Mr. Snowberger has been associated with the company for nineteen years, and has been master mechanic for the last two and one-half years.

F. W. BOYE III was elected vice-president of the Boye & Emmes Machine Tool Co., Cincinnati, Ohio, at the last annual meeting of the board of directors.

Texas and California

GENERAL ELECTRIC CO., Schenectady, N. Y., has made the following appointments in the southwest district: R. T. SHIELS, manager of the industrial department at Dallas, Tex., has been made assistant to the district manager; H. A. WHITE, manager of the El Paso office, succeeds Mr. Shiels at the Dallas office; E. C. WISE, of the general sales department at El Paso, has been made manager of that office.

RANSOME CONCRETE MACHINERY CO., Dunellen, N. J., has appointed W. S. HILER & CO., 427 W. San Antonio St., El Paso, Tex., representative for welding tables and positioners in western Texas, New Mexico, Arizona, and Mexico.

A. C. GELDNER has been promoted from the position of assistant district sales manager at Los Angeles, Calif., for the Republic Steel Corporation to district sales manager.

* * *

A turbine generator operating in hydrogen, installed about two years ago at the Consolidated Edison Co.'s Waterside Station in New York, is expected to save $500,000 in coal alone annually.

OBITUARIES

Fred W. Coombs

Fred W. Coombs, vice-president of the Gisholt Machine Co., Madison, Wis., died on July 29 in Orlando, Fla., of a cerebral hemorrhage, at the age of sixty-nine. Mr. Coombs was born January 5, 1870, on a farm in Grant County, Wisconsin. He worked on his father's farm until he was twenty-one and then took a course in accounting at the Valparaiso, Ind., School of Business. He entered the employ of the Gisholt Machine Co. in 1895 as a bookkeeper and time clerk. During the World War he was given the responsibility of managing the North West Ordnance Co., which was organized as an associate of the Gisholt Machine Co. to manufacture heavy guns for the United States Army. Mr. Coombs had retired from active service with the company in 1937 because of failing health. He is survived by his wife, three sons, and a daughter.

Van S. Wunder

Van S. Wunder, subscription representative for MACHINERY and HEATING AND VENTILATING in Kentucky and parts of Ohio and Indiana, died suddenly of a heart attack on July 26, at his home in Springfield, Ohio. Mr. Wunder was born in Cincinnati on October 26, 1867. He started his business experience in the Cincinnati offices of the Queen and Crescent Railroad. Later he went to Chicago, where he was employed by the Illinois Central Railroad. Previous to going to Springfield, he was connected

Van S. Wunder

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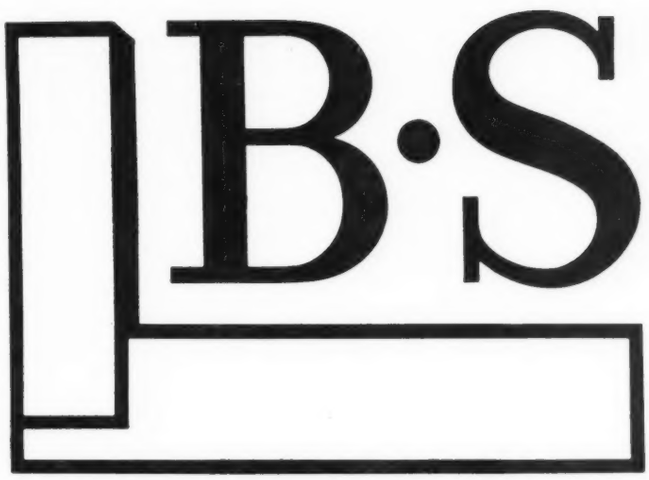


EQUIPMENT

Machinists' Tools
Cutters and Hobs
Magnetic Chucks
Vises and Pumps
Miscellaneous Equipment

& SHARPE

with several construction companies in such capacities as office manager, paymaster, etc. He is known to many readers of MACHINERY, having been engaged in selling the publications of The Industrial Press for the last twenty-two years. His friendly personality made him well liked throughout his territory and his many friends will greatly regret to learn that he has passed away. Mr. Wunder is survived by his wife and a son, Van S. Wunder, Jr.

Henry D. Shute

Henry D. Shute, vice-president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., with whom he was connected for thirty-eight years at the time of his retirement in 1931, died on July 15 at his home in Miami, Fla., aged sixty-seven years. Mr. Shute was born in Somerville, Mass., and graduated from the Massachusetts Institute of Technology in 1892. Following his graduation, he went abroad and continued his technical education in Germany.

Upon returning to this country, he started work as a student-apprentice with the Westinghouse organization. For several years he served in various capacities in the engineering, sales, and other departments of the company, and in 1906, was made assistant vice-president. In 1910 he became acting vice-president, in 1914 treasurer, and in 1917 vice-president in charge of sales. In 1925 his vice-presidential duties were changed from sales organization to direction of the broader commercial policies of the company, the position he held until his retirement from the corporation eight years ago.

Ralph M. Rumbel

RALPH M. RUMBEL, manager of the meter division of the Westinghouse Electric & Mfg. Co. at Newark, N. J., died on July 31 in Clarion, Pa., from heart trouble. Mr. Rumbel was born in Rington, Pa., in 1879, and was graduated from Pennsylvania State College in 1903 as an electrical engineer. The same year he enrolled in the student engineering course at the Westinghouse Works in East Pittsburgh. From 1906 to 1912 he held the positions of service engineer, assistant superintendent, and superintendent of service for the company in Chicago, Cleveland, Cincinnati, and Pittsburgh. He was appointed service manager of the Pittsburgh district in 1912, and service manager of the central district in 1928. In 1934 he was promoted to the position of manager of the meter division at Newark, a position that he held until his death.

GEORGE F. SHIRLEY, sales representative of the O. S. Walker Co., Inc., Worcester, Mass., died on July 30 at Providence, R. I.

COMING EVENTS

SEPTEMBER 4-8—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Engineering Societies Bldg., 29 W. 39th St., New York City. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

SEPTEMBER 20-22—Conference of the NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION, to be held at the Hotel New Yorker, New York City, under the sponsorship of the Technical Publicity Association of New York and the Industrial Marketers of New Jersey. For further information, communicate with William H. Easton, 420 Lexington Ave., New York City.

SEPTEMBER 28-29—Tractor meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Schroeder, Milwaukee, Wis. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

OCTOBER 4-13—NATIONAL MACHINE TOOL BUILDERS' EXPOSITION in Cleveland, Ohio. General Manager, Tell S. Berna, 10525 Carnegie Ave., Cleveland.

OCTOBER 5-7—National aircraft production meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

OCTOBER 6-7—Annual meeting of the FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION at the Greenbrier Hotel, White Sulphur Springs, W. Va. Executive secretary, Arthur J. Tuscany, Penton Bldg., Cleveland, Ohio.

OCTOBER 15-21—Fortieth annual NATIONAL AUTOMOBILE SHOW, to be held at the Grand Central Palace, New York City. Further information can be obtained from the Automobile Manufacturers Association, General Motors Bldg., Detroit, Mich.

OCTOBER 16-18—Twenty-second semi-annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at Whitcomb Sulphur Springs, St. Joseph, Mich. J. C. McQuiston, manager-secretary, 602 Shields Bldg., Wilkensburg, Pa.

OCTOBER 16-20—NATIONAL SAFETY CONGRESS AND EXPOSITION in Atlantic City, N. J. For further information, address the National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

OCTOBER 23-27—NATIONAL METAL EXPOSITION to be held in conjunction with the annual meeting of the AMERICAN SOCIETY FOR METALS in the International Amphitheater, Chicago, Ill. W. H. Eisenman, secretary, American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio.

DECEMBER 4-8—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Bellevue-Stratford Hotel, Philadelphia, Pa. C. E. Davies, secretary, 29 W. 39th St., New York City.

DECEMBER 4-9—Seventeenth EXPOSITION OF CHEMICAL INDUSTRIES in the Grand Central Palace, New York City. For further information, apply to Charles F. Roth, president of the International Exposition Co., Grand Central Palace, New York City.

JANUARY 15-19, 1940—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

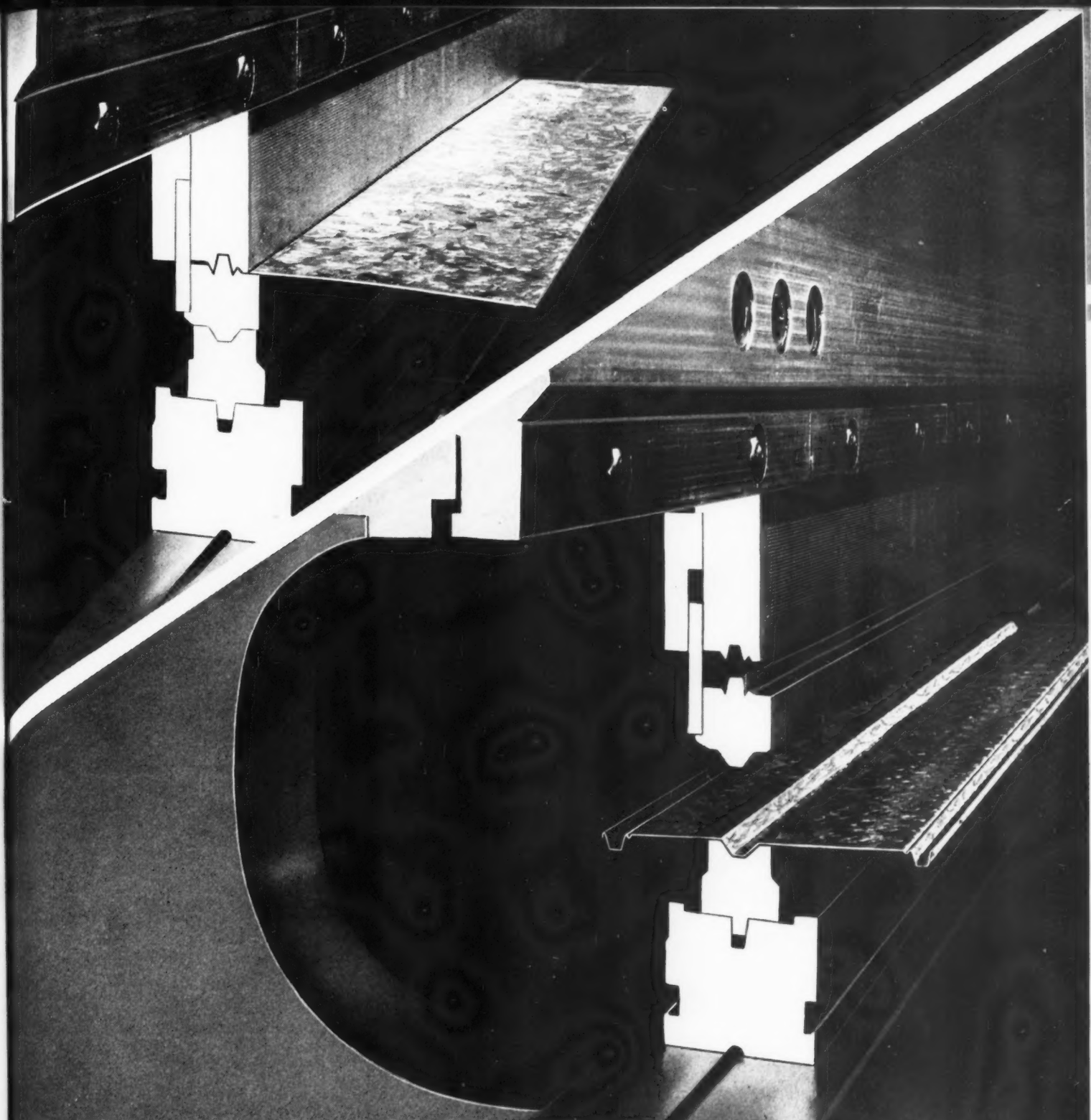
MAY 6-10—Convention and exhibition of the AMERICAN FOUNDRYMEN'S ASSOCIATION to be held in Chicago, Ill., with exhibits at the International Amphitheater, and headquarters of the convention of the Palmer House. American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

* * *

New Process Prevents Glare from Reflected Light on Glass Surfaces

Glare from reflected light on glass surfaces can be eliminated by a new process developed in the General Electric Research Laboratory. By applying a thin chemical film to the surface of glass, the rebounding light rays are "neutralized," with the result that, for example, pictures framed with glass so treated appear as though there were no glass at all, irrespective of the angle from which the picture is viewed. The same is true of clock faces, showcases, display windows—in fact, wherever glare is caused by light reflections on glass.

The process is still in the laboratory stage and has not yet reached the point where it can be offered to the public. However, it is believed that it will soon enter its practical application stage. The glass to be treated is dipped into a tank of liquid, on the surface of which is an extremely thin film of the chemical to be applied. As the glass is pushed down, one layer of the film becomes attached and as it is pulled up another is applied. The dippings are continued until forty-four layers have been applied, equivalent in thickness to about four millionths of an inch. This non-glare treatment of glass also promises to have a widespread application in the camera and telescope fields, and for any instruments where lenses are used.



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NEW BOOKS AND PUBLICATIONS

APPLIED ECONOMICS FOR ENGINEERS. By Bernard Lester. 464 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $4.

In observing over a period of years the progress of a great number of engineering graduates as they enter the various fields of technical work, the author of this book, who holds an important executive position with the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been impressed with the importance not only of a clear understanding of economic principles, but also of a knowledge of the application of these principles in the many branches of engineering. It is quite generally felt that the young engineering graduate, while proficient in actual technical subjects, lacks this clear understanding of economics and lacks appreciation of the importance of the application of economic principles to engineering.

The author, therefore, has provided a comprehensive treatise on this important subject primarily for students in engineering, although the book will also be found equally useful to anyone engaged in industry who wishes to obtain an understanding of the economic principles underlying the successful management of an engineering enterprise.

In preparing his book, the author has had in mind another aspect of engineering education and training that many educators overlook. Though fundamental principles remain largely unchanged, their application in technical fields continually assumes new aspects. For this reason, a particular effort has been made to assist the instructor in establishing the habit, on the part of the student, of consulting worthwhile articles in current periodicals.

In a brief review, possibly the best conception of the contents of the book will be furnished by a listing of the main chapter headings: Economics and the Engineer; Principles and Methods of Planning; Human and Public Relations in Industry; Industrial Organization; Standards and Standardization; Principal Elements of Cost; Statistical and Accounting Methods; The Requirements of the User; Problems of the Supplier in Development Work, Production, and Purchasing; The Market for Technical Products; The Distribution of Technical Products; The Functions of Organized Selling; Price and Pricing Policies; The Engineer as a Citizen; and Examples of Economic Studies.

The book is one that can be highly recommended not only to engineering students and young engineers, but to older engineers and business executives as well.

OPERATION ANALYSIS. By Harold B. Maynard and G. J. Stegemerten. 298 pages, 6 by 9 inches, 107 illustrations and charts. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City, Price, $3.

The importance of increasing the productivity of labor in industry as a means of enabling a greater number of people to share in an ever-increasing material prosperity, is being recognized by everyone who has an accurate conception of the purpose of industry. Consumers as a whole can share only what industry produces; and, however, much there is still to be desired in regard to equitable distribution of industry's products, the importance of increasing production is obvious, since nothing can be shared or distributed until it is first produced.

For this reason, the authors of this book, who are prominently identified with the production departments of the Westinghouse Electric & Mfg. Co., have endeavored to describe the procedure for conducting operation analyses—that is, for finding means for improving existing methods and processes so as to obtain production increases. The principles set forth are simple, commonsense ideas which are readily understandable to, and can be applied by, any practical shop man. The applications of the principles have been illustrated by numerous examples drawn from many branches of industry.

An idea of the contents of this book may be obtained from a list of some of the chapter headings: Methods Engineering in Industry; Operation Analysis; Types of Methods Study; Process Charts; Analysis Sheets; Complete List of All Operations Performed; Inspection Requirements; Material and Materials Handling; Set-Up and Tool Equipment; Ten Common Possibilities for Operation Improvement; Man and Machine Process Charts; Plant Lay-Out Practices; Working Conditions and Methods; Progress Process Chart.

INDUSTRIAL MARKET DATA HANDBOOK OF THE UNITED STATES. By O. C. Holleran. 907 pages, 9 by 12 inches. Published by the Department of Commerce, Washington, D. C. Price, $2.50.

This new guide book for American business men contains information of use in establishing new sales territories, production quotas, and marketing campaigns. It gives complete figures on industrial production; employment; value of products; cost of material, fuel, and power; and output per wage-earner for each of the 3070 counties in the United States, and similar data for every city having a population of more than 10,000. The figures in the book pertain to 1935, the latest year for which data in this form is available.

This book offers what is believed to be the most complete collection of statistical data dealing with the size and location of American industrial markets now available to business men. It was prepared as a cooperative study by the Bureau of Foreign and Domestic Commerce, the Bureau of the Census, and the Bureau of Mines.

ENGINEERING QUESTIONS AND ANSWERS. 176 pages, 7 1/4 by 9 3/4 inches. Published by Emmott & Co., Ltd., 31 King St., W., Manchester 3, England. Price, 6/.

This book contains a compilation of questions and answers previously published in the *Mechanical World*. It is the second volume of these questions and answers, the first book, which was published in 1935, having been so well received that a second volume seemed desirable. The questions contained are those that have arisen from the problems encountered by engineers in the course of their work and cover a wide variety of subjects.

EYES ARE EXPENSIVE TARGETS. A talk given by K. R. Sutherland before the Michigan State-Wide Safety Conference in Detroit. 16 pages, 6 by 9 inches. Distributed without charge by the American Optical Co., Southbridge, Mass.

This little pamphlet contains valuable information concerning the cost of eye accidents, the causes of eye accidents, and ideas about putting into operation a plan for eliminating the causes.

LOOK AND LISTEN—THE TELEVISION HANDBOOK. By M. B. Sleeper. 96 pages, 6 by 9 inches. Published by the Norman W. Henley Publishing Co., 2 W. 45th St., New York City. Price, flexible, spiral binding, $1; cloth binding, $1.50.

This little book describes 1939 television practice for service men, set builders, and students.

MOTOR DICTIONARY. Compiled by Benno R. Dierfeld. 261 pages, 6 1/4 by 9 1/2 inches. Distributed by the Chemical Publishing Co., Inc., 148 Lafayette St., New York City. Price, $4.

This is the second enlarged edition of a dictionary of motor terms in English, French, and German. The equivalent terms in the three languages are given, but no definitions are included.

FATIGUE TESTS OF BUTT WELDS IN STRUCTURAL STEEL PLATES. By Wilbur M. Wilson and Arthur B. Wilder. 58 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 310 of the Engineering Experiment Station. Price, 65 cents.